ELECTRICAL REVIEW

[ILLUSTRATED]

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Weston's Laboratory and the United States Electric Light Company's Works at Newark, N. J.

Whilst visiting Newark the other day, your reporter called at the United States Electric Lighting Company's works, and through the courtesy of Mr. George B. Prescott, Jr., Mr. Weston's able and accomplished assistant, passed the forenoon very delightfully in a visit to the factory and laboratory. A visit to the shops, as thorough as a somewhat limited time would allow, left me impressed with the superior quality of work turned out, and the care and system displayed in every detail.

The laboratory consists of a labyrinth of passageways leading to numerous apartments, each for a special character of work —the one for chemical experiment, another for photometric tests, another for lathework, etc., etc., and indeed, it is a model.

One of the principal aids to successful experiment in the electrical, as well as other fields, is accuracy of measurement, and, in this particular, certainly, Mr. Weston has surrounded himself with all the latest and best means of its accomplishment.

In the department devoted to electrical measurements, the greatest care is exercised to insure accuracy, and every precaution is taken to avoid error. The more delicate galvanometers are mounted on piers passing clear of the flooring to firm foundations in the earth, thus eliminating any chance of error from the jarring of the building. An idea of the delicacy of action of these instruments may be obtained from the statement that, after adjustment, the lifting of the foot from the floor will cause a deflection owing to an alteration, by the nails in the shoe, of the magnetic equilibrium! It would be impossible for me to describe the many objects of interest to be seen, a volume would not suffice, but I have selected one which is of prime importance—it is Mr. Weston's modification of Clark's Standard Cell. As is well known, the Clark cell is composed of pure mercury, upon which floats a paste of mercurous sulphate, a plate of zinc resting on the paste.

In the course of some of his experiments, Mr. Weston discovered that cells made up of pastes prepared at different times, differed considerably in electromotive force from each other, and this was observed in many subsequent tests extending over a considerable period of time—suffice it to say that after patient investigation the cause was discovered and the remedy found.

The modification consists principally in using mercurous sulphate in solution (46.5 Baumé), instead of in paste, and greatly increasing the space it occupies.

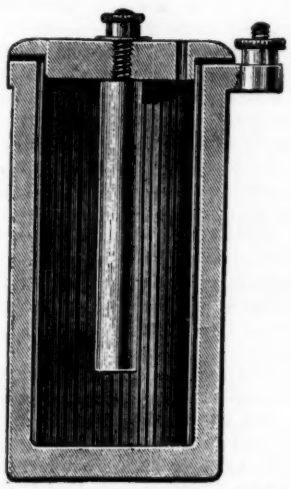
The glass bottle containing the elements, as shown in section by the diagram above is contained in an outside cylindrical brass box with a vulcanite cover. Around the bottle is poured melted paraffine.

The zinc in the stopper is held in place by paraffine solidiefid around it.

As the result of numerous careful tests the electromotive force of this cell has been found to be practically constant and equal to 1.434 volts, according to Lord Rayleigh's determination of the ohm. They may be reproduced at any time, and always with the same electromotive force.

Applegarth's Patent Corrugated Battery Cells.

We are indebted to the London *Electrical Review* for the following: The illustrations show a very convenient and portable form of battery, devised by Mr. R. Applegarth, suitable for electric bell and telephonic work. The outer jar is of carbon with the inside surface corrugated, so that the latter is of a considerable extent, and tends to reduce polarization in the cell. A zinc rod lies in the axis of the jar, and is fixed to a varnished wooden cover; the under surface of the rim of the latter has a rubber ring fixed to it, which closes the mouth of the jar very effectually. A simple clamp secures the cover. The charging solution is salammoniac. The battery, we understand, gives satisfaction.



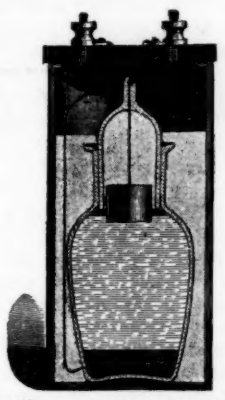
APPLEGARTH'S CORRUGATED BATTERY CELLS.

A Short History of Incandescent Lamps.

Our contemporary, the London *Electrical Review*, has the following interesting paper on this subject; "For years, (that is to say, ever since the electric light, advancing with great strides towards perfection, gained for itself a well-deserved place amongst the various technical applications), it has been a moot question whether it is intended to supersede the existing sources of artificial light, especially the gaslight, the use of which became universal in such a short time; and whether it must be regarded as the sole means of illumination of the future. For a long time this question appeared to be answered, in certain circles, in a manner unfavorable to the electric light; as one of the many objections to the electric light, it was pointed out that it—the general public understood by it that term, the arc light, which was that time exclusively used—suffered, as it were, from an *embarras de richesse*, as the flood of light which issued from the electric lamps was, in consequence of its great intensity, only fit for the illumination of vast spaces, whilst the gas still appeared to be the source of light most suitable for general and domestic purposes.

It is true that the electric arc light may be considered capable of a division at least approximately adequate to the demands of practical generalisation, as it is at present possible to divide the current over lamps with intensities varying from 20 to 10 gas flames. But, on the one hand, that minimum of intensity is in many cases, especially for domestic purposes, a great deal too high; whilst, on the other hand, the regulating mechanism is so expensive that, in this case at least, the electric light cannot compete with the gas light as regards cheapness. It is evident that, under those circumstances, it would be of the utmost importance to possess a lamp which could produce, without the aid of regulating mechanism, an electric light of far less intensity, say of a minimum intensity of one gas flame.

But the laborers in this field had to encounter numerous errors and disappointments, until they at last succeeded in hitting upon the correct and practical thing. The history of the glow lamp may also be considered as the history of the errors made in the field of electro-technical research. Notwithstanding the scientific earnestness which



WESTON'S MODIFICATION OF THE LATIMER CLARK STANDARD CELL.

animated the laborers in that field, it makes often a really comical impression on us when we, studying with attention the history of the development of the glow lamp, represent to ourselves the frantic exertions of some inventors, who were in many cases powerfully supported by speculating capitalists, and when we observe how many an inventor allows the decisive moment to approach in the belief of having at last reached the ideal of his wishes, in order to awake at the next moment from his dream, and see before him instead of the longed-for glow light globe, a deceitfully twinkling soap bubble, which at the first touch is shattered into milliards of atoms, and leaves the disheartened inventor nothing but bitter disappointment.

The great problem to be solved was to invent an electric conductor which in a vacuum would neither burn away nor be vaporised; and now succeeded a burrowing and hunting after the treasures which lie concealed in the deep shafts of science, to bring forth which each enthusiastic student of the natural sciences felt himself called. It was at first principally American capital which supplied the funds necessary for the pursuit of an idea, from the realization of which golden fruits were justly anticipated.

Bearing in mind that all roads lead to Rome, inventors attempted to reach the goal in various ways, and by the most different means, until at last the conviction dawned upon them that there are only two substances in existence which possess, in a sufficiently high degree, such properties as are indispensable for the production of the glow light, namely, platinum or an alloy of platinum and iridium, and secondly, carbon.

Platinum has this advantage over carbon, that it, even when heated to whiteness, does not consume away in the air, a property which caused that metal to be regarded as particularly suitable for glow light purposes; but in another not less important respect that metal is far behind carbon, that is to say, that it is by no means capable of sustaining such a high degree of heat without fusing. It is evident that when light is to be produced by means of glow lamps the conducting material must possess the capacity of resisting an exceedingly high degree of heat.

This circumstance, especially when considered from an economical point of view, has a very high importance, as the quantity of light emitted by a glowing substance rises in a more rapid proportion than the temperature of that substance. When we, for instance, heat to redness a piece of platinum wire or of carbon filament, very little or no light is emitted; but if we double the degree of temperature by passing a current of double strength through the conductor, we shall obtain more than double the quantity of light. It cannot, therefore, be disputed that the higher the degree of heat to which we raise the glowing material, the less will be the cost of the energy expended on the light.

Carbon or Metal?—This was now the great question which occupied for decades every thinking electrician, and which the most able representatives of electro-technics set themselves the task of solving. It will not at all be uninteresting to describe the history of this movement which has become so important, and during whose course visions of success, which created more or less justifiable sensation, comet-like appeared and vanished.

We will now give a concise account of the most important phases of the abovementioned movement, and only dwell longer on the labors of such prominent workers as De Changy, King, Starr, Edison and Swan, whose experiments and their results we purpose to consider more minutely.

It was Prof. Jobard, of Brussels, who gave the first impulse to the highly important experiments with glow lamps. This savant suggested in the year 1838, in the *Courrier Liberal*, that a small strip of carbon in a vacuum used as conductor of a current, would emit an intense, fixed, and durable light. Prof. Jobard then advised his former pupil, De Changy, to attempt the practical realization of his idea. De Changy was the more ready to enter upon the necessary experiments as he, in his capacityof mining engineer, considered he would be able to open up a wide field for glow light illuminations in the shafts and galleries of mines.

After some preparatory theoretical study De Changy commenced his labors in the year 1844, after an Englishman of the name of Moleyns, had, as early as 1841, made the first experiments with platinum glow light amps. De Changy made use of gas carbon

cut into thin strips, which he enclosed in an exhausted glass and connected with the conducting wires. In order to impart more consistency to the carbon strips he attempted to fill up their pores by soaking them in melted rosin or in sugared solutions. The result attained was relatively favorable, and De Changy proceeded to the construction of the first carbon glow lamp. This was, however, the first link of that chain of experiments which runs like a thread through the history of the development of the glow lamp. The experiments failed, on the one hand, by the carbon strips becoming disintergated by the current, and, on the other hand, because the electric energy required for the production of the light was too great, and the degree of heat generated in the carbons too intense.

The lamp was also imperfectly sealed and the vacuum insufficient, in consequence of which circumstances the carbon partially consumed away in the oxygen of the air. A heavy loss of electric energy to the light effect was due to the generation of heat, and to currents of the insufficiently rarefied air. However, the above-mentioned results may, from a theoretical point of view, be considered as satisfactory, as they establish the principle of the glow lamps, and demonstrate the possibility of its realization. But it was also evident that the glow lamps, which were produced from time to time in different places, were not at all capable of being converted to practical use. Shortly after this rather encouraging experience De Changy received the appointment of engineer-in-chief to the Weal-Ocean and Weal-Ramoth mines, in consequence of which his interesting studies and experiments were interrupted for a long period.

While De Changy occupied himself in Europe with the construction of a practical glow lamp, strenuous and industrious efforts were made in the new world, almost at the same time, to realise the same idea:—J. W. Starr, of Cincinnati, a savant as able as modest, entered upon a thorough study of the glow light, and made experiments with platinum as well as with carbon. As Starr possessed only a very moderate income, he would scarcely have been able to bring to a satisfactory result those wearisome experiments which entailed such heavy expenses, if he had not found in Peabody a munificent Maecenas and high-minded promoter of his plans.

Peabody, whom fate had blessed with an immense fortune, was a zealous promoter of undertakings of public utility, and has earned, as founder of magnificent and richly endowed scientific institutions, a glorious name, which will be handed down from generation to generation.

He took an especial interest in the toilsome exertions of the modest American philosopher, and afforded him considerable support; and when Starr proceeded at last to the construction of his first glow lamp, Peabody supplied him with the means necessary for a journey to Europe, in order to enable him to lay his invention in a practical form before his British colleagues and the British public.

Before entering upon his journey Starr procured himself a companion in the person of a countryman of his, named King, who as a shrewd man of business, would be able to guard the philosopher, who felt at home in his chemical laboratory only, against a premature publication of his invention, and to guide him in other respects with his experience.

Arrived in England, King's first care was to interest competent experts in Starr's ideas, and to gain over the general public by a most effective exhibition. With this view he caused a large and magnificent chandelier, with 26 branches, to be constructed; 26 electric flames were to represent symbolically the 26 States of which the North American Republic then consisted. The anticipated effect did not remain behind; a gigantic crowd gazed at the splendid and novel spectacle; and Faraday, the celebrated philosopher to whom the scientific world is indebted for the discovery of electric induction, who witnessed the interesting experiment, signified to his American brother electrician in the most flattering terms his satisfaction with the result attained.

But it was not given to Starr to enjoy the fruits of his labors. Soon after the conclusion of the above-mentioned experiment the Americans sailed for their home, with the purpose of redoubling their efforts for bringing their glow lamp to perfection. When Starr's cabin was entered on the day after his leaving England, the able electrician was found dead in his bed. The cause of his death was not ascertained, and is likely to remain for ever an unraveled mystery.

After the tragical death of Starr, King, the practical man, took forthwith possession of his inheritance, and hastened to patent Starr's invention in his own name. The patent was granted on the 4th of November, 1845, and refers to *a glowing carbon strip in a vacuum*, or to a platinum wire glowing in the air. With the death of Starr, the funds necessary for the costly experiments ceased to flow, and in a short time the promising glow lamp, which had been inaugurated with so much pomp, was consigned to oblivion. A similar fate befell the invention of the Englishmen Greener and Staite, who patented, in the year 1846, a carbon lamp. The carbon of this lamp, which bore a striking resemblance to that of King, was cleaned with nitric acid.

In one of the recent numbers of *Nature* we read the following interesting letter from Prof. Williams, a contemporary and colleague of Starr, respecting the invention of De Changy and that of Starr-King:

"In your periodical I notice a statement to the effect that a Mr. De Changy is the first electrician who, about twenty years ago, attempted to produce electric glow light in a vacuum. With reference to that statement I declare that the invention in question was made by a young American of the name of Starr, who was successful in obtaining a practical result. Another American, King, patented Starr's invention in 1845. Starr made use of a short strip of gas carbon, and formed his vacuum in the following manner: he passed a wire through the top of a barometer tube, and closed hermetically the opening by which the wire entered; he connected the carbon strip with this wire, that strip being also, by means of a second wire, in connection with the mercury in the tube. The tube was 36 inches long, so that when it was filled with mercury and then inverted, a Torricellian vacuum was formed.

"I assisted the inventor myself in the construction of his apparatus, and in the experiments made with them; my remuneration was to be one-eighth of the profits. After the death of Starr all his apparatus became my property. I have, more than 20 years ago, several times exhibited the original lamp in the Midland Institute at Birmingham, and also showed it in action there. I also exhibited the lamp on two occasions in the Town Hall. The light was far clearer and the carbon strips were far more durable than the thin carbon filaments of the glow lamps of the present day.

"Starr's invention was abandoned, because the generation of the necessary electricity was too expensive; as regards effectiveness and clearness of light the lamp was a complete success."

Without wishing to detract in the least from the merits of Williams or of Starr, we believe to have proved satisfactorily by the above-mentioned authentic dates, that De Changy was occupied with the construction of glow lamps long before Starr made his invention public. But as regards the merit of having invented the glow lamp—if there can be here at all a question of invention—neither De Changy or Starr can claim it, as the ingenious idea of Prof. Jobard gave in the year 1838 the first impulse to the practical application of the principle of the glow light.

Three years after the granting of the Greener-Staite patent, in 1849, Petrie proposed in a patent to use iridium for glow light purposes. The use of that metal had been advocated by other electricians before as well as after Petrie; but, from an economical point of view, it could not be used, being, in consequence of its scarcity, too expensive.

Ten years after King had patented his lamp, in the year 1855, De Changy resumed his experiments and studies with redoubled zeal. He made experiments at the same time in two directions. Without altogether abandoning carbon, he occupied himself with the construction of a glow lamp, in which platinum formed the conductor, as he imagined to attain by the use of that metal a success more speedy, although less perfect, yet of sufficiently practical value. Being well aware that in order to guard the platinum wire against the risk of fusing, the strength of the electric current must strictly be kept within certain limits, he constructed a current regulator which he patented in 1858.

The lamps provided with such a current regulator would be used for various very interesting purposes, as, for instance, for the illumination of mines, submerged for fishing purposes, for illuminating anchor buoys, and, finally, as a nautical telegraph by which with the aid of an instrument like a keyboard, signals consisting of flashes of light could be transmitted from the top of the mast of a vessel. The platinum for these lamps was submitted to a peculiar process of preparation. De Changy caused the metal to be maintained some time heated to a moderate degree of redness, and then gradually raised it to that degree of heat to which it would be required to be heated for illuminating purposes.

The Silver Question.

Under the existing laws of Congress 25 80-100 grains of gold, nine-tenths fine, containing 23 22-100 grains of pure gold, constitute a dollar, and 412 50-100 grains of silver, nine-tenths fine, containg 371 55-100 grains of pure silver, constitute a dollar, and the producers or owners of pure gold can take it to the United States Mints in unlimited amounts and have it coined into money by paying the costs of the alloy. The expense to the Government for getting the coined gold into circulation being only the mintage, while the coinage of silver is limited to not less than $2,000,000 and not to exceed $4,000,000 per month, and instead of coining it on the same footing that gold is coined the Government purchases it outright and keeps it out of circulation by locking it up in its vaults.

Since the law was enacted in 1878, limiting the coinage of silver, its annual production has been $37,000,000 to $48,000,000 actual value, and the annual coinage about $28,000,000 coin value, or $24,000,000 actual value, after deducting the loss of about 15 per cent. sustained by the producers. The annual loss to the producers on the entire product of the country aggregates $6,000,000 to $7,000,000 by reason of this unjust legislation against silver, and aside from the loss to the entire people by retarding its production and circulation. The expense sustained by the Government is practically about $24,000,000 annually, which would cease, and this amount would be saved to the people and could be applied to other purposes, if individual coinage of silver prevailed as formerly. Besides, with individual coinage the silver would go into circulation from the hands of the producers as fast as it is coined, and the price being advanced its production and coinage would be doubled in a very short period, thereby stimulating all other enterprises and benefitting the whole people.

The rapidly increasing population and more extended commerce, together with the falling off in the production of gold from year to year, and the constantly increasing amount of gold used in the arts and manufactures, are potent reasons for increasing the coinage and circulation of silver.

—— On the occasion of a recent ball Messrs. Woodhouse and Rawson lighted the Crown Hotel, at East Grimstead, in England, by the electric light. Inside the building incandescent lights were used, while arc lights were employed outside. The whole work of installation was completed inside of three days.

DETROIT, MICH., Feb. 25, 1885.

Editors of the Electrical Review:

I notice, in an address before the British Association, held in Liverpool in 1837, and again in a paper prepared for the Agricultural Report of 1859, page 453, and in substance repeated before the American Association at Newport in 1860—

1st. "The electric fluid consists of atoms so minute as to exist between the atoms of gross matter."

2d "The atoms of the fluid repel each other."

3d. "The atoms of the fluid attract the atoms of ordinary matter;" and

4th. "The atoms of the fluid can move freely through certain bodies of gross matter, such as metals, water, etc., which are hence called conductors, and cannot move, or but very imperfectly, through other bodies, such as glass, dry air, etc., which are called non-conductors."

Quotations to the same effect might be extended indefinitely, but these give the gist of the matter, and must therefore suffice.

Let not, however, my purpose in making them be misunderstood. Speaking in the interest of science and truth, and endeavoring to correct a pernicious scientific error, to show in what that error consists, I must quote from some one who is generally accepted as scientific authority. But even then I would not be justified in doing so, if it were a trivial matter. But this question involves a fundamental principle, and hence must be the source of most pernicious and disastrous results to any system into which it is incorporated. It is the stumbling block that impedes progress and trips up every scientific explorer in the domain of electricity. It is misleading the world, and it will continue to mislead it and prevent it from acquiring correct ideas of electric action until it is exposed and exploded.

One of the fundamental ideas of the quotations, when analyzed, is that electricity is matter—a fluid with such minute and attenuated atoms that they move freely through gross matter. If this is true, then electricity is matter—sublimated and refined, to be sure, but nevertheless matter. This conception is even grosser than that of Thales, who discovered it six hundred years before the Christian era; he conceived it to be the "soul of matter." In 1839 John Robert Mayer, of Heilbrun, Germany, made the formal announcement of the greatest scientific discovery of the century, namely, the mutual interconvertibility of the physical forces. The doctrine of the mutual convertibility of the physical forces is not a theory, but a demonstrated truth. Thousands of times, and in every conceivable way, it has by experiment been verified that light, when it disappears, is converted into heat; that, when heat disappears, it is converted into electricity; and that when electricity disappears, it is reconverted into heat and light. This is what is meant by the mutual convertibility of physical forces.

How does this fact harmonize with the dogma that light, heat and electricity are fluids composed of minute atoms?

If they are atoms, then in this transformation an atom of electricity must change its nature and properties and become an atom of heat, but instantly this atom of heat changes its properties again and becomes an atom of light. Seeing this incongruity between the doctrine advanced in the quotations, suppose some one should promulgate the notion that an atom of iron, under certain conditions, would become an atom of copper, under new conditions, in an instant, this atom of copper would change into an atom of silver, and a moment after, under different conditions, this atom of silver would change into an atom of gold—would such a notion be considered science or nonsense?

The Ethiopian cannot change his skin nor the leopard his spots. The *nature* of a thing is inexorably fixed by Fate. It may change its state as to being a solid, a liquid or a gas; it may unite with other matter and form various compounds, and, as far as our senses are concerned, the distinctive character of the parts may become undistinguishable, but an atom of gold will exist as an atom of gold

forever, and so with the rest. Since this law governs inexorably the grosser kinds of matter, it must also govern matter, however refined or sublimated. Since we know it does not govern the physical forces, we know they cannot be matter. Since the physical forces are not matter, therefore electricity, which is one of them, cannot be matter. What is it? Light, heat and electricity are all *pure force*, and we have no ideas of force except what is revealed to us—that is, manifested through matter.

Likewise, all our ideas about matter are the force it manifests. Hence, force and matter must be essentially different in their nature and properties.

For instance, the existence of matter without weight, or, as it is called, ponderosity, is inconceivable. By experiment it has been demonstrated that illuminating, heating or electrifying a body does not alter its weight. Hence, scholastics have termed what they call gross matter ponderable, and the physical forces, which they deem subtle fluid, or refined and sublimated matter, imponderable.

Now, according to the quotations, the atoms of this sublimated matter attract gross matter. How wonderful! These atoms, freely moving through solids and permeating space, act upon solid matter, pull it hither and thither, which pull causes its ponderosity! They make matter go to them, instead of their going to matter, which, from their having no ponderosity, and therefore incapable of offering resistance, we would infer they would naturally and inevitably do. Evidently, there is something here for scholasticism to learn and unravel, notwithstanding it has the reputation of knowing everything worth knowing.

Why is it that matter manifests ponderosity, unless it be the effect of force operating upon it? And if it be force, then what force can it be except electricity? They must all concede that it is electricity. Then the next question demanding an answer is: How can a force react upon itself and impart to itself any property not inherent in it? The reason why a force cannot have ponderosity is, therefore, self-evident. How would it be possible to give itself weight without attraction? But we have seen that, according to the above quotationss, "the atoms of this subtle fluid repel each other!" How can they repel each other without both repellants manifest weight? From what we have seen, it is evident that a knowledge of what a physical force is, and of what are the laws and modes by which such a force acts, cannot be ascertained by delving into the lore and speculations of book-men.

They have involved themselves in the inextricable mazes of the labyrinths of scholastic subtleties, where they are themselves lost, and where every one will be lost who follows them. What, then, are the simplest ideas we have of a physical force?

It is the fact that the matter of the physical world under different conditions manifests different phenomena Sometimes it emits or reflects rays of light; sometimes it radiates heat; at other times sends forth electric sparks, and at all times it is in motion. The cause of one species of these phenomena we call light; of another, heat; and still of another, electricity. With Grove, we therefore call a physical force *an affection of matter*.

If it be an affection of matter, then it is inseparable from it; then it cannot exist where there is no matter, nor can it go anywhere unless it be conducted by matter, or matter goes with it and conveys it. Electricity is that physical force which causes that peculiar state or condition in matter in which it manifests what are called electric phenomena. Whatever any physical force may be in the abstract, in the concrete it is an affection of matter. Electricity, whose mode of action is involved in this discussion, is, therefore, an affection of matter permeating space, because space is filled with matter in a gaseous state, and affecting all bodies in space. But space and the bodies disseminated through it being in opposite electric states, therefore the phenomena of celestial motion is produced by electricity. On and in our planet it causes earthquakes and volcanic action, and rain, hail, snow and thunder-storms, whirlwinds, tornadoes and waterspouts in our atmosphere. In space it causes the motion of the sun, moon and stars.

Very respectfully,

J. C. CHAMBERS.

Navigable Trains of Air Ships.

We are indebted to our contemporary, *Scientific American*, for the following illustration of two very complete and interesting models of an air ship—one designed to be used as a war vessel and the other for the carriage of passengers and merchandise—invented and patented by Captain Carl W. Petersen, an experienced master mariner, are now on exhibition at 231 Broadway, this city. The inventor states that he has now seventy-eight improvements in air ships protected by the patent laws of this country, and will soon present to the Patent Office about two hundred and fifty more. His genius in this line is apparently boundless.

The framing is so arranged as to strengthen the structure, and, as the car suspension gear is connected to the lateral framing, no suspension netting or covering is needed, thus doing away with the dangerous chafing and rubbing on the upper surface of the balloon. The weight saved by this method of construction may be applied to strengthening the outer surface of the gas vessel, so as to enable it to easily withstand the pressure of the air caused when the train travels with great velocity. One of the most important features of this invention is the coupling or uniting of separate balloons into a row or train of balloons, thereby increasing the length and lifting capacity to any desired extent without adding to the transverse sectional surface presented to the air. Wire cables are used in the car suspension gear, which is not only fire-proof, but much lighter than any heretofore employed. The cables pass through the cars—the openings being made water-tight—between the car frame and sides, so as to show a smooth outside surface. The cars are shaped so that a cross section is a true circle; this form presents less resistance to the air, and can be given maximum strength with the minimum weight of material. By means of the central row of rudders the train may be turned in a very small circle by setting the front and rear rudders properly. The central rudders serve as centerboards, and, when all the rudders are set at the same angle to the center line, the train of ships will be moved to the right or left without altering the real course; or, in other words, the ship can be held head to the storm while moving to either side. The various parts of the train are so constructed and arranged that either end may be used as the head, the speed being the same in both directions.

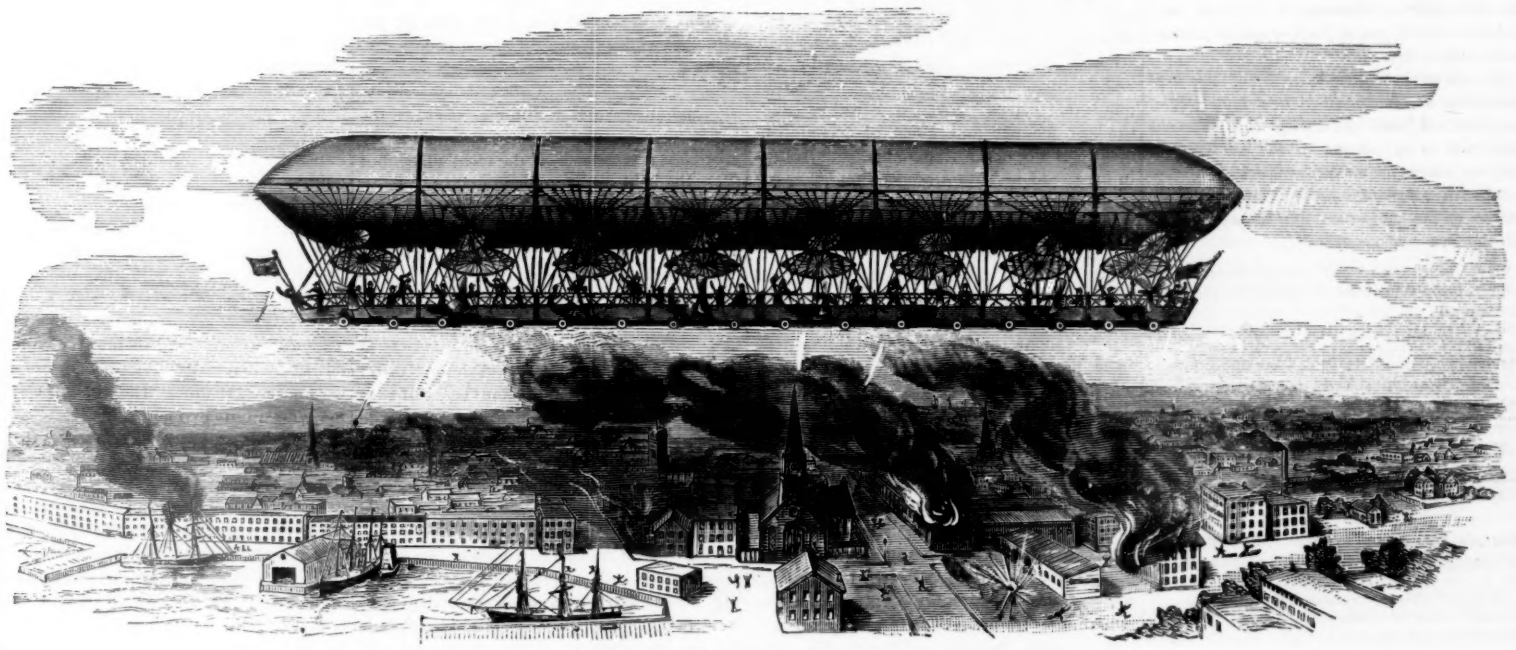
To allow the train to ascend or descend at pleasure, one or more rows of adjustable screws are provided. This obviates the necessity of allowing gas to escape from the balloons, or of throwing ballast from the cars. Gas lost from any cause can be replaced at any one of the stations designed for the air ship trains. Waste of gas is prevented, and, as the rows of screws allow the train to travel through the air at an elevation of only a few feet from the ground, the danger to life and property is reduced.

When rows of stationary screw propellers are used in place of adjustable screws, rows of guiding sails or wings are pivoted on each side, below the balloons; by these trains may be steered in vertical places. The row or rows of electric or other motors form a valuable part of the apparatus, since, if one should be disabled, there would still be ample power to insure good work.

A disabled air ship could be disconnected at any station, and a perfect one easily and quickly put in its place. In case of storm, the air ships composing a train could be increased in number, so as to furnish sufficient power to overcome the force of the wind.

The inventor claims that the train principle of air navigation insures great carrying capacity, much motive power, great velocity, complete navigability, and the greatest safety to life and property. It is also claimed that, as the end ships are tapered like a cigar, the train will easily penetrate the air, and the opening made by it will permit the other vessels in the train to follow without causing any resistance to the air. The vessel is expected to make from 20 to 80 miles an hour. The lifting power of hydrogen is about 68 pounds for every 1,000 cubic feet; from this it is easy to calculate the load the train will bear; but, in addition to this load, it is stated that about 55 pounds more can be carried at an upward inclination of the train of about two degrees from the true horizontal line for every indicated horse-power of the motors, and also that the real horizontal pull of each indicated horse-power of the air propeller has been ascertained to be about 100 pounds. The general construction of the war ship is shown in the accompanying engraving.

To carry out the designs of Capt. Petersen and build navigable trains of air ships, a company has been incorporated, under the laws of this State, with a capital of $100,000. Capt. Peterson is president, and Mr. Henry Stevens secretary.



PETERSEN'S AERIAL WAR VESSEL.

* * At Glasgow, Scotland, a lightning conductor, of seven strand copper cable ¾ inch in diameter, and having a conductivity of 98 per cent., and fitted with a permanent testing wire, has been fitted on one of the shafts owned by the Glasgow and South Western Railway Company. After completion the conductor was tested, and the total resistance found to be .5 ohm. It is said that this is the first lightning conductor fixed in Glasgow having a permanent testing wire.

Permanent Magnets.

To the Editors of the Electrical Review:

GENTLEMEN:—It may interest those having permanent magnets of the horse-shoe form, to know that completing the magnetic circle of attraction at any other point than at the ends of the arms, permanently reduces the strength of the magnet; and drawing the armature from the ends of the arms to *U* is ruinous.

This is probably due to the displacement of the poles. WM. B. COOPER.

Philadelphia, Feb. 17, 1885.

* * Electricity is being advantageously applied in Calais for removing the incrustations from boilers. Two poles of a battery of ten to twelve Bunsen elements are applied to the ends of the boilers, and after thirty or forty hours the deposits fall from the sides to the bottom. When a boiler has been thus cleared the formation of new deposits may be prevented by applying a much less energetic current under the same conditions.

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NEW YORK, FEBRUARY 28, 1885.

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A convention of those interested in electric lighting in the United States and Canada met at Grand Pacific, Chicago, on Wednesday, with an attendance of over a hundred delegates representing all parts of the Union and all the systems except the Edison. The great interest manifested from the commencement and the large attendance was a surprise. Mr. William A. Hovey, of the *Electrical Review*, called the Convention to order, and stated the object of the Convention and the many advantages that could be expected from an annual Convention of electric light men. Mr. George S. Bowen, of the Van De Poele Company, Chicago, was made temporary chairman, and H. D. Stanley, of the Bridgeport Brass Company, temporary secretary. Committees on permanent organization and credentials and on programmes were appointed, and at 2 o'clock made their report: For President, J. F. Morrison, of the Brush Company at Baltimore; First Vice-President, H. M. Cleveland, of the Schuyler Company at Hartford; Second Vice President E. M. Barton, Western Electric Light Company, Chicago; Third Vice-President, J. H. Yarbrough, of the Brush Company at Nashville; Secretary, William A. Hovey, of the *Electrical Review*. All who signed roster were admitted as delegates. The Committee on Programme reported sixteen questions for discussion, all relating to the practical operation of plants, leaving matter of systems out of the discussion. The discussion about crossing with telephone wires and induction was particularly animated and quite generally participated in. The following subjects were selected for discussion:

First. Incandescent lighting, particularly in regard to length of current upon which they can be run with profit. Second. Locating and avoiding crosses with telephone wires. Third. Power and its conversion into light. Fourth. Electric light globes and shades. Fifth. The best modes of connecting dynamos with power. Sixth. Electric lighting by water power. Seventh. Rates and rebates on electric lights by the year. Eighth. The use of electricity as applied to motors. Ninth. Where an electric light system requires number six conductors, is it desirable to use Nos. 6 and 4 in the same line? Tenth. Will armatures become affected by frost when exposed in transportation. Eleventh. Special insulation or guards to insulation of lines at dangerous points and places. Twelfth. Street lighting, the best manner and mode of accomplishment. Thirteenth. Experience and results in the use of underground conductors.

We shall give a complete report in next week's edition.

Mr. Geo. L. Phillips, assistant general manager of the American Bell Telephone Company, and for years an active worker in the telephone field, contemplates retiring from business life, to spend several years abroad, educating his children and enjoying the abundant fruits of years of successful business life. It is likely that he will spend this summer in Switzerland.

Two bills are pending before the Missouri Legislature, which emanate from St. Louis, one of which requires all telegraph, telephone and electric light wires to be placed underground in cities of over 200,000 inhabitants, and the other contains the same provisions, and includes cities of the first, second and third classes. Had these bills much prospect of becoming laws, it would look to a man up a pole as if the State did'nt want the "modern improvements," but they are not very likely to be enacted.

There is a very decided factor engaged in the electrical field that has much to do with the wonderful advancement, and that is *young blood*. There is in no other profession the demand for bright, vigorous and ingenious minds as that found in the study and prosecution of electrical invention. In all our large cities many of the extensive electric light and telephone interests, and the manufacturing and supplying interests, quite generally, are controlled and managed by young men. The cry, "Give the young man a chance," is receiving its proper fulfillment in the young man taking it.

One of the Western railroads is trying the experiment of doing away with a telephone at its freight depot in Kansas City. As a consequence, the freight agents of the rival lines are in an exultant mood, and one of the companies has ordered extra telephones in anticipation of increased business. The day is past when any company, especially where there is active competition, can expect to maintain itself at the front without furnishing all possible facilities for quick transaction of business. Live business men the world over, and particularly in the active West, will always be found patronizing those elements that give the quickest and surest aid in the carrying on of trade.

A hearing has been going on before a committee of the Massachusetts legislature, in which the whole relation of telephone companies to the public and to other corporations is being overhauled. There is an evident disposition on the part of some of the Bay State's law-givers to step in and regulate prices, and the Baltimore and Ohio Telegraph Company is on hand with a grievance. It seems that the New England Telephone Company refuses to place telephones in the offices of the Baltimore and Ohio company, on the ground that a contract between the parent Bell Company and the Western Union forbids its doing so. It is sought to be established that a telephone company is a common carrier, and that it cannot be bound by contracts which give to any party or parties exclusive privileges. By the telephone company it is contended that this is not the case, and—hence these tears.

THE ELECTRIC RAILWAY IN AMERICA.

So much has been done in an experimental way to demonstrate the value of electricity as a motor on railways that it will indeed be surprising if something practical is not begun when Spring opens. The place of places for such an enterprise on a scale large enough to be called commercial, yet sufficiently limited to be capable of accomplishment without the investment of a very large amount of money, is one or the other of the principal summer resorts where people congregate in large numbers during the hot weather. Of course, Coney Island—probably the most popular Summer resort in the world if the number of visitors is to be taken as a standard—is the ideal place, but there the field seems to be tolerably well occupied by roads using steam. But there are other resorts where many thousands assemble, and to either of these a practical electric railway, either as a means of reaching it or as a means of getting from one part of the grounds to the other, would be a great and valuable attraction—an attraction so great, in fact, that the proprietors could afford to be very liberal in the matter of concessions to persons who would undertake such an enterprise in good faith. It is one of the axioms of railroading that no one has yet discovered how cheaply passengers can be carried provided there be enough of them to carry. It is because at such a resort as we have mentioned large numbers of persons are assembled, all on pleasure bent—all seeking something new and all provided with some money—that it is desirable to select it for the introduction of the electric railway on a commercial basis, even though on a small scale. The business is not yet out of the purely experimental stage in this country, and it never will be until it is taken out neck and heels and set up against the test of actual experience. Then, and not till then, will real progress in the adaptation of electricity to use as a motive power on a railway actually begin. To start it on an ordinary road and set it at once in competition with steam, would be a costly and hazardous experiment; but such a beginning as we have outlined would be safe, and with anything approaching judgment in the management it could not fail to be remunerative. The experience of the Brighton road in England, where gas was used to produce the initial motive power, which did a large and remunerative business, and that of the Portrush road in Ireland, which, though having less business, has still done well, ought to convince capitalists that the scheme we have outlined is practicable and that it would pay as a separate venture, besides paving the way for larger operations in the future.

Of course, the contentions between parties owning different patents have had much to do with the backwardness of the electrical railway interest in this country, but these, as we understand it, are in a fair way to be speedily settled, and then there would seem to be no reason why a vigorous push should not be made. As a matter of fact, electric railroading is more advanced to-day than was electric lighting when it was first offered to the public, and the one thing that has expedited the improvement in electric lighting in all its branches has been the urgent demands growing out of its actual commercial use.

OVERHEAD WIRES.

There seems to be a lull in the storm of indignation and misrepresentation concerning overhead wires. We say misrepresentation advisedly, for no one who has, during the past eighteen months, watched the expressions of alleged public opinion in the press of the country at large concerning overhead wires, and the dangers and annoyances that arise from their use, can have failed to notice the uniformity with which absolute and even ridiculous falsehoods have been seized upon, magnified, and made the basis for column editorial comment in large and most impressive type. No one has forgotten that "purple flash," so vividly described by the press of New York and Boston, which was alleged to have resulted from the fact that a horse slipped on a broken electric light wire, nor the thrilling details of the death of the horse, without a struggle and without a groan. Long after it was proved that there was no flash, and that the horse that received the shock felt it so little that he did not even fall, and went on with his work as though nothing had happened, the papers continued to revel in the lurid glare, and to paint in vivid colors the picture of that soul-harrowing scene. A gentleman whom we could name put in no little time telling reporters and others that the ladies of New York were afraid to drive down town in their coupes for their husbands, because of the terrible danger that lurked in the wires, and at last was made happy by seeing his silly story in print. Of course, the fact that he was engineering a big scheme for a conduit company had nothing whatever to do with his zeal in the matter; but it was a little curious that while he was at work sowing the seeds of distrust and fear in overhead wires, he was also vigorously pushing the scheme in question, planning to interest capital in this and other cities, and making arrangements for the necessary legislation. Happily for this city, the scheme died a-borning, the bubble was pricked and had the wind let out of it before it was half blown, and then, strange to say, the clamor about the terrible dangers of overhead wires ceased almost entirely. To be sure, now and then there is a sporadic eruption in some paper that cannot forget how fruitful a theme for comment this had proved in the past; but even these begin to realize that the public is just a little tired of it, and troubles itself very little about the wires anyway. The public does not like the wires any more than it likes horse-car tracks in the streets or elevated tracks on the avenues, but how are you going to get on without them? Shall we say that New York shall be gridironed with tunnels from end to end and from side to side, for the accommodation of horse cars and steam trains, because tracks in the streets are annoying to drivers of vehicles, and because the elevated tracks are unsightly and exclude light from lower stories? Or shall we take the other and broader ground, and say that the advantages which these things bring in their train are as much to be considered as the disadvantages, and that, setting the one against the other, it is found that the balance is immensely in favor of retaining them as they are and where they are?

In the single matter of overhead wires for telegraphic use, it is to be noticed as a fact that their removal, and substitution for them of underground wires exclusively, would mean the shutting-up of four-fifths of the telegraph offices in this city. Is the public, which is using the telegraph more and more every day, not only for business purposes, but for every possible variety of social purposes, ready to see this done? Would it not rather, on the other hand, see the wires remain overhead and an increase in the number of offices?

The result of all the talk and all the agitation is likely to be that, of future construction, a very considerable proportion will, when practicable, go underground; that underground work will take the place of some

small part of what is now overhead; and that, in ten years from now, with the introduction of the new uses of electricity that that time is sure to bring, we shall have far more overhead work than we now have. But it will be better done, will be less obtrusive and more substantial than now; and the public will have learned that it is not such a terrible thing after all.

The new Boston exchange of the New England Telephone Company, which has been under construction for some months, is at last completed, and went into operation on Sunday last. It has the latest form of the multiple board, and is connected up for two thousand subscribers, with room enough left on the boards to increase the number to forty-five hundred, should such an increase be demanded. The transmitters are hung on cords which pass over rollers, and are counterbalanced, so that they will stand at any desired elevation. Head telephones are to be used, but, although of small dimensions, they will be fastened to the shoulder rather than to the head, so as to enable the operator to rest her ear when not at work. The boards are in one long row, in a handsome, well-lighted room, incandescent lights supplying the illumination after dark. Cables are used exclusively for carrying lines from the building, so that the immense overhead structures that are now so plentiful in that vicinity can be removed, greatly to the joy of property owners. There are now over forty operators connected with the exchange, but it is believed that the number can be reduced below thirty, probably to twenty-five. So far as construction is concerned, the Boston Exchange of the New England Telephone Company is to-day the model exchange of the country, and is well worthy a visit from all telephone men anxious to see the latest and best things in this line. The Boston operators are, as a class, as prompt and intelligent in their work as any to be found in the country, and, after a little practice—they have never handled a "multiple" before—it is believed that they will do as good work as is done anywhere, if not better. The New England Company has been going over its plant with great care, not only in Boston, but throughout its territory, and has expended large sums in needed construction and reconstruction. The money for this has come from earnings, and a cessation of dividends has therefore been necessary. But the time is approaching when this work will be completed, and then, with its plant in first-rate shape, and with its present large earnings, there would seem to be no good reason why it should not pay reasonable dividends upon its participating capital.

By stipulation with bondholders of the Bankers and Merchants' Telegraph Co. Receivers have until March 15 to straighten out the company's affairs. The bonds redeemed by the Receiver are part of $10,000,000 first mortgage issue, of which $4,500,000 were sold and remainder pledged to secure loan of $600,000. Receivers have compromised with pledgees of $3,500,000 at about sixty cents on the dollar, and hope to compromise with them for the other $2,000,000 before the above date. The redeemed bonds will be retired and parties holding Receivers' certificates will, the Receivers say, keep them off the market.

The McDaniel and Barrett telephone switchboard, in which the subscriber calling is answered and the subscriber called for, is rung up by one and the same movement of the operator's plug, is certainly ingenious, and places the invention in the rank of meritorious ones.

Mr. Charles Selden, the talented superintendent of telegraphs for the Baltimore and Ohio Railway Company, is receiving numerous congratulations over his recent invention of the sextuple instrument. If it proves the success now reported from Baltimore, Mr Selden and the whole telegraphic fraternity are to be congratulated.

The financial statement of the International Bell Telephone Company (limited) shows the following result of its business during the year 1884:

Receipts.....	f.1,193,041	say $239,208
Expenses, interest on bonds, construction, first payment to Russian Government for concession, etc.....	f.1,122,201	say $224,400
Surplus.....	f.73,840	
Surplus from 1883..	90,183	
	f.164,023	say $32,805
Add first four months of 1885 at same rate.....		10,000
Surplus May 1, 1885.....		$42,805

It is proposed, May 1, to pay a dividend of 2½ per cent. The total number of subscribers in Russia Dec. 15, 1884, was 2,529. The company has other exchanges in Italy, Spain, Belgium, Holland, Germany and other European countries. Its capital is $1,700,000. The Continental Telephone Company of Boston has a large interest in this company.

The Kansas City Telephone Exchange has increased from 319 subscribers, February 15, 1883, to 912 subscribers, February 15, 1885—an increase of 593 in two years, or over 186 per cent. Can any other exchange excel this?

Mr. H. D. Lyman, of Boston, ex-second Assistant Postmaster-General, was recently announced by the office boy, to a party of prominent telephone people gathered in a private office in this city, as "a lineman from the American Bell Telephone Company." The joke of the innocent boy was so good that the party zealously insisted on Mr. Lyman climbing a pole to prove his right to the title; but the matter was finally compromised, and apologies accepted.

Mr. T. A. Edison and daughter, and Mr. E. T. Gilliland and wife, intend taking a vacation and spend the next six weeks or more in Florida. They expect to get out of call by telegraph or telephone, and to quietly enjoy themselves with a well-earned rest; but it is very probable that two such eminent electricians, by being together, will find it second nature to study out some important electrical problem, and return to their work with its solution.

Execution was issued out of the Common Pleas Court of Philadelphia last week against the Baxter Overland Telephone Company by S. T. Cord on a judgment for $3,200, entered upon a note drawn on Monday and payable on demand. The consideration was money advanced and purchases made for the company.

During the month of December the New England Telephone Company earned $76,123.19, and the amount expended in operating $65,625.33, and in construction $15,831,102, a total of $81,456.35, leaving a deficit of $5,333.16. For the quarter ending December 31, the gross income was $229,568.29; the operating expenses, $183,508.77; net income, $46,059.52; construction, $57,664.06, and deficit, $11,604.54.

There is a rumor afloat that the Mexican Telephone Company will pay a dividend ere long.

Old telegraphers quite generally will be sorry to learn that the health of E L. Patch, for years an active worker with the key, has compelled him to resign his position as superintendent of the American Express Company at Kansas City, and go South on an extended visit. The express company, recognizing Mr. Patch's services in the past, have given him the appointment of general agent, in which the duties will not be so severe, and the emoluments about the same.

Mr. H. C. Sprague, superintendent of telegraphs for the Kansas City, Fort Scott and Gulf Railway, has had his telegraph and telephone wires brought into the new general office building, at Kansas City, in one thirty-wire cable—eighteen telegraph and seven telephone wires. The cable is 100 feet long, of Patterson make, and the absence of induction is specially noticeable. The telegraph wires are looped in, and the telephone wires grounded in the building. Mr. Sprague is well satisfied to find the lines working so well side by side, and confesses that he had doubts of the success of the plan at the time he ordered it carried out.

Several years ago, when Mr. Edison was improving his knowledge of telegraphy under Wiley W. Smith, now general superintendent of the Missouri and Kansas Telephone Company, but at that time chief operator for the Western Union at Cincinnati, it became necessary to relieve one of the most expert operators on account of the heavy load of old Rye he had on board, and "Tom" Edison was given his desk and key. To have his chair filled by "that pesky little crank" was more than the dignity of the expert could bear, and, as best his thick tongue would permit, he informed Mr. Smith that his heart was broken, and that he would never work there again, and he departed and was never heard of more—although the "pesky little crank" has been.

On the 20th inst. the French press called attention to the opening of the Bennett-Mackay cable. Says the *Gaulois*, "Europe and America were connected by another submarine cable. The final splice was finished at Havre in the presence of a large gathering. In a few days the whole work will be completed by the opening of a special wire to Paris. That city will thus be in direct communication with America. The energy with which the undertaking has been pushed through seems to have surprised our French contemporary *France*. It says: 'Scarcely had the idea been conceived when it was put into force. The construction and the laying of this immense cable across the ocean were effected in less time than a French company would require for the mere discussion of the project. Since the dispatch of the first message yesterday the bond between the two continents has been drawn closer. Differing from the cables of other companies, whose systems are completed by land line connections, the Bennett-Mackay system is exclusively submarine.'" "The cable," continues the *Gaulois*, "leaves the company's offices in the boulevard Strasbourg, Havre, passing underground to Belleville, whence it takes the sea via Waterville to Canso, N. S., and New York. It is needless to dwell upon the great benefit the scheme offers both to commercial and private business, rates being reduced from 2f. 50c. to 2f. a word, so evident is the advantage to the public, who must appreciate it. Some people," says the *Gaulois*, in conclusion, "were ridiculous enough to protest against the new line being worked by foreigners. Some papers even started a crusade against M. Cockery for encouraging the patriotic work. Happily, the Minister of Posts and Telegraphs did not allow himself to be influenced. He understood the advantages which would accrue to France from the scheme, and has shown himself worthy of approbation as having the public interest at heart."

—— As the result of recent tests in the Grand Opera House, in Paris, the arrangements for eleetric lighting have been modified. The "Cance" lamps have been discarded, and the central chandelier now has 120 16-candle Edison lamps The effect is said to be exceptionally fine.

—— The United States Electric Light Co. have secured the contract for lighting the Washington Monument. The power will be a 25 horse-power Westinghouse Engine.

The Telephone Dead Head Evil.

If there is a single source of more trouble and trials to the telephone manager than the "dead-head," the writer would like to know what it is. The non-subscriber is a regular "ghost that will not down," but "bobs up serenely" in all sorts of ways, and places. Between him, servants, and children, with the troubles they cause, tacked on to the legitimate ones that pertain to the business, under the best of circumstances, the managers head grows gray long before his time. We wonder if any one has any idea of the actual amount of business done in every exchange this broad land over, for which no pay whatever is received? Of course there is a certain amount of such work that is unavoidable. In fact it is all so, as a rule. Some one says: "Cut 'em off." "Refuse connection." Yes? Try it, and see if it is not 'out of the frying pan into the fire." It is easier and much less trouble to make the connection (even when you are certain it is D. H., and that you are not always sure of by any manner of means) than to cut them off. Then too, it is poor policy to give operators liberty to refuse any one connection. It is their duty to connect the different lines in the shortest time, and with the fewest words possible, "only that and nothing more," and as soon as you allow any latitude beyond that, you have another and prolific source of trouble.

With the system generally in use of a fixed rental for the telephone, without regard to the amount of use, the dead head flourishes, and is the most difficult to deal with. Still it should not be impossible to so manage as to derive some revenue from, and at the same time materially reduce the number of connections of this sort. To do this with any prospect of success, you must first make it an *object to subscribers to assist you*. How? Suppose telephone companies were to print and sell tickets in slips of five or six, the same as is done by some street car companies. Each ticket good for one local connection at any telephone—with the permission of the subscriber. Now, in making the regular rental collections, these tickets would be accepted by the company at fifty per cent. of their face, in payment of telephone rent. This might not be a complete cure for the evil, but it would undoubtedly tend to reduce it considerably. It would also enable many small retail dealers, doing business in the poorer neighborhoods (whose inhabitants are unable to afford the luxury of a telephone in their residences, and still have occasional use for one, doctors calls and the other) to keep a telephone at small cost to themselves, while the company would receive more than the regular rental. Stores in suburban parts of cities would find it work to their advantage also. In fact, in many ways it would redound to the advantage of both the companies and their subscribers, making every telephone practically a public toll telephone, earning an income for the company over and in addition to the regular rental, and reducing the cost to the subscriber; spreading a knowledge of the great convenience the telephone is to the public, and making it more and more a necessity. Of course subscribers can, and undoubtedly do; now, charge for the use of their instrument by outsiders; but when their customers know that it costs them nothing extra they are not apt to pay except with thanks; while on the contrary if it was the general rule to charge for connections, and they understood that subscribers were losers by their free use of the telephone, they would feel compelled to pay or, leave it alone. Either of which would be entirely satisfactory.

Beyond question some such an arrangement will have to be adopted soon, or a radical change made in the manner of paying for telephone service. For the evil is constantly on the increase, and at present every company and exchange is doing much unnecessary work; work for which they receive nothing but abuse, but of that a *most* liberal allowance. A. F. A.

—— New Britain, Conn., is soon to be lighted by the electric light.

Telephonic News

*** The Erie Company put out 169 instruments in December and took in 323, making a net loss for the month of 154 sets, and leaving the number in use December 31 at 8,999.

*** The Oram time machine has just been put in operation at Portland, Me. Subscribers are much pleased with it. The time can be easily understood at any point in or about Portland, and even can be heard at Lewiston over a wire—a distance of forty miles.

*** A Montreal dispatch says: The Bell Telephone Company of Canada is out with a notification to the public that proceedings are now pending for the purpose of having the recent decision of the Commissioner of Patents voiding the Bell patent set aside as inoperative. No battery transmitters can be made without infringing one or the other of this company's numerous patents, and proceedings will be taken to prevent any infringements.

*** The Railway Telegraph and Telephone Company, of which Thomas A. Edison, Sigmund Bergmann and Charles Batchelor are the corporators, filed its certificate here last Thursday. Its objects are to regulate and apply electricity to telegraphy and telephony generally, and more particularly to telegraphing and telephoning between railway trains when in motion, and between moving trains and stations and places on their route. The capital steek of the company is $1,000,000.

The Electric and Telephonic Underground Conduit Company also filed its certificate. It has a capital of $1,000,000. The corporators are James Hood, Rufus W. Leavitt and John Weaver.

*** The Telephone Company of Austria has, during the past year, made great strides in the towns of Prague, Trieste, Gratz, Lemberg, Krakau, Czernowitz, Pilsen, Rickenberg and Bielitz, for which the company holds exclusive concessions. In January, 1884, the number of subscribers was 436, which has now increased to 811; and it is expected that at least 400 additional paying subscribers will be connected up during the present year. The above will be of interest to the shareholders of the Consolidated Telephone Construction Company, as that company is a large holder of debentures and shares in the Telephone Company of Austria, and, moreover, manufactures all the instruments which are used in the Austrian exchanges.

*** Some long-distance telephoning has just been accomplished by the engineers of the International Bell Telephone Company, who successfully carried out an experiment by which they were enabled to hold a conversation between St. Petersburg and Bologna, a distance of 2,465 miles. Blake transmitting and Bell receiving instruments were used, and conversation was kept up notwithstanding a high induction. The experiments were carried on during the night, when the telegraph lines were not at work. The Russian engineers of this company are so confident of further success that they hope shortly to be able to converse with ease at a distance of 4,665 miles; but to accomplish this astonishing feat they must combine all the conditions favorable for the transmission of telephonic sounds.

*** Long-distance telephoning is a feature of the telephone business that is still to a great extent a matter of experiment. Lines are in successful operation between Boston and Providence, and are in daily use for commercial purposes. Messages are also transmitted between Boston and New York, and generally with satisfactory results. Men are constantly employed in the experimental department of the Bell Company in developing the system, and as fast as the distance is increased the margin of power remaining is ascertained, and serves as a basis for further experiments. Conversation has been carried on between New York and Chicago, but the conditions were exceptionally favorable and the results wholly satisfactory. With batteries in good condition, wires clear, and transmitter and receiver in perfect order, it is possible for experts to attain results that would not be practicable under ordinary conditions. The copper wire in use between Boston and New York weighs 185 pounds to the mile; and for telephoning a thousand miles it would be necessary to use a wire so heavy that the expense would be very great, and in order to get a fair rate of interest on the investment it would be necessary to put the rates so high as to prevent a general use of the line. But it has been found practicable to telephone a few hundred miles, and the New York line will soon be extended to Philadelphia and Washington.

It is claimed that a new wrinkle in telephones has been discovered and is indorsed by Prof. Bell, by which messages transmitted by telephone are taken down automatically upon paper in the same way that the telegraph prints the Morse alphabet upon paper. This telephone improvement is being kept a close secret, only two or three having been given any knowledge of it, while Prof. Bell is working to perfect it in order to obtain a patent upon it.

The Direct Cable Repaired.

The cable steamer Minia has arrived at St. Pierre, Miquelon, after successfully repairing the great cable, which was broken 330 miles from Torbay, N. S. The vessel left Halifax, Sunday Feb 8, and completed the final splice on the 17th instant. This repair is remarkable for being the quickest ever made on an Atlantic main cable in the winter. Captain Trott reports very severe weather and large fields of floating ice.

The following preliminary injunction was granted the American Bell Telephone Company against the United States Telephone Company of New York in the United States Circuit Court last week:

PRELIMINARY INJUNCTION.
CIRCUIT COURT OF THE UTITED STATES,
Second Circuit, Southern District of New York.

[SEAL.]

The President of the United States of America to the McDonough Telephone and Telegraph Company, the United States Telephone Manufacturing Company, James W. McDonough, Horace H. Eldred, Anthony W. Dimock, Samuel D. Schuyler, Jeremy S. Case, Garrett S. Mott, and W. A. Willard, you and each of you, your and each of your attorneys, agents, servants and workmen, *Greeting:*

Whereas, it has been represented to us in our Circuit Court of the United States, for the Second Circuit and Southern District of New York, that Letters Patent of the United were issued in due form of law, on the 7th day of March, 1876, to Alexander Graham Bell, for an Improvement in Telegraphy, numbered No. 174,465, and that other Letters Patent of the United States were issued in due form of law on the 30th day of January, 1877, to said Alexander Graham Bell, for an Improvement in Electric Telephony, numbered No. 186,787, that you, the said, The McDonough Telephone and Telegraph Company, the United States Telephone Manufacturing Company, James W. McDonough, Horace H. Eldred, Anthony W. Dimock, Samuel D. Schuyler, Jeremy S. Case, Garrett S. Mott and W. A. Willard, have infringed the rights secured by said Letters Patent, and each of them contrary to the form of the statute in such case made and provided.

Now, therefore, we do strictly command and enjoin you, the said The McDonough Telephone and Telegraph Company, The United States Telephone Manufacturing Company, James W. McDonough, Horace H. Eldred, Anthony W. Dimock, Samuel D. Schuyler, Jeremy S. Case, Garrett S. Mott, and W. A. Willard, you and each of you, your and each of your attorneys, agents, servants, and workmen, under the pains and penalties which may fall upon you and each of you in case of disobedience, that you forthwith, and until the further order of the said Court, desist from making or using, furnishing to others for use, or selling, in any way or manner, directly or indirectly, any electric speaking telephones or telephonic apparatus whatsoever, embracing and embodying the invention and improvements or any material and substantial part thereof, set forth and claimed in said patents to Bell, No. 174,465, and No. 186,787, or either of them.

Witness, the Honorable Morrison R. Waite, Chief Justice of the Supreme Court of the United States, at New York City, this 14th day of February, 1885.

TIMOTHY GRIFFITH,
Clerk.

I certify that the foregoing is a true and correct copy of an injunction, this day issued out of my office.

TIMOTHY GRIFFITH,
Clerk of the Circuit Court of the United States for the Southern District of New York.

[SEAL.]
New York, Feb 14, 1885.

The Telephone in Lancashire and Cheshire.

The working of the telephone in Lancashire and Cheshire is in able and competent hands, and, now that the new licences granted by the Postmaster-General have made extensions possible, every advantage is taken of the new position of things by the directors of the Lancashire and Cheshire Telephonic Exchange Company. In Manchester, Liverpool, Blackburn, Preston, and other towns in Lancashire and Cheshire, public call stations are opened, where any person, whether a subscriber or not to the Telephonic Exchange system, may speak to any firm or person that is on the company's list of subscribers. The toll for conversing to a person or firm within the limits of the town spoken from is 3d. for three minutes, or fraction thereof, and 6d. for the same period if the conversation is with a person or firm in another town in the district, by what is termed a trunk-wire message. Twelve different call offices are already established in Manchester, and it is stated that further stations will be opened at an early date. The Company's Telephonic Exchanges in Manchester, Liverpool, Blackburn, Preston, and other large towns in this district, will shortly be connected with the chief post-offices of those towns, and subscribers who arrange for the service may send and receive telegrams direct, and thus save the time now occupied by messengers. In addition to the trunk-wire service at the disposal of the general public, as well as the company's subscribers, from call stations previously described, it is intended to bring the convenience within easy reach of all the company's exchange subscribers, and they will now enjoy the privilege of speaking from their offices to subscribers in other towns, either by payment of a fixed sum yearly in advance, or by a toll per message, of which the company will make record and furnish a monthly account. For each end of the trunk-line the ordinary annual rate, per renter, will be 10s. per mile (single circuit), with a special proviso that the minimum charge at each end of the line shall be £5 per annum to yearly renters. The toll-rate from subscribers' offices will be 6d per message of three minutes, or fraction thereof, to any town in Lancashire or Cheshire. The rates for messages to towns in other counties will be published when wires are available for use Special rates to the press, between 8 P.M. and 8 A.M. The following is a list of the towns in Lancashire and Cheshire which are now connected:

Accrington, Ashton-under-Lyne, Blackburn, Bolton, Burnley, Bury, Chorley, Darwen, Heywood, Liverpool, Manchester, Middletown, Oldham, Preston, Radcliffe, Rochdale, St. Helens, Stockport, Warrington, Widnes and Runcorn, and Wigan. Other towns in Lancashire, Cheshire, and Yorkshire will shortly be connected with those named above. The foregoing gives proof of healthy development, in which, we trust, the other companies will share.—*Invention, London.*

Telephone News Down in Georgia.

ATLANTA, Ga., Feb, 26, 1885.

Editors of the Electrical Review:

So many things are transpiring here daily in the electrical field, that I hardly know which to write about first.

Mr. J. R. Dillon, of Savannah, has organized a burglar alarm company here, and established quite a p'ant for the short time he has been at work.

His central office is nicely located on the third floor of the James Bank Building, corner of Alabama and Whitehall Streets. He has thirty buildings wired up and in connection, and will probably double the number within thirty days. The construction work has been done hurriedly, and is very poor, and should the number of customers increase to any extent, will undoubtedly have to be rebuilt.

Mr. Dillon also stole a march on some of the Atlanta boys, by slyly marrying one of the prettiest girls in the city, about three weeks since.

The Georgia Electric Light Company seems also to be on a boom. They have recently secured an order from the city for twenty street lights, to be followed by more if these prove satisfactory. They have orders ahead for 20 or 30 other stations, and the work of enlarging their plant is progressing rapidly. Mr. A. N. Oldfield, for many years Superintendent of Telegraph for the Atlanta & Charlotte Air Line Railroad, has been engaged as their Superintendent, and is devoting all his time to the work.

The Atlanta Telephone Exchange continues to grow rapidly, and is fully appreciated by the business men of the city.

On January 23d, the city was visited by a very severe sleet storm, which broke down hundreds of wires, and also six large 60 foot cedar poles, but everything was in thorough working order by the 27th, just four days. Manager Gentry had his hands full during the time, but his long experience in the business enabled him to keep an even temper, and while pushing the work of repair with all speed, conciliate the subscribers who were minus telephones.

W. J. Cole, District Superintendent was on the spot when the break occurred, and lent a willing hand toward clearing the streets, although the slush and ice were nearly knee-deep.

Mr. George H. Cole, for several years past connected with the Western Electric Manufacturing Company, has been permanently engaged by this Company, and is now engaged in setting up a 1,200 wire Law multiple board for Atlanta Exchange. It is confidently expected that this board will be in operation by March 20th, and it will be one of the wonders of the South to telephone men.

Mr. A. W. Prior, of Williamsport, Pa., has also been engaged by this exchange, and is at present on the inspection force.

Mr. C. C. Carlin, Manager of Rome, Ga., Telephone Exchange, visited Atlanta last Sunday.

Mr. D. I. Carson, of New York, General Superintendent of the Southern Bell Company, spent several days in Atlanta last week, and seemed well pleased with the progress of the exchange.

The Georgia Electric Time Company, under the management of J. M. Stevens, Manager of the Western Union Telegraph offices, has begun operations, and the people are delighted with the electric clocks. He has about 200 to start with, and expects to operate about 1,800 clocks.

Yours truly,

ATLANTA.

.... Said Cicero, "To live long, it is necessary to live slowly." It will be seen from this that the district messenger boy is determined to reach a ripe old age.

The Inventor and the Business Management.

Inventors of the present period find it requires wholly as much skill to introduce and sell their patent as it does to originate the invention itself.

All praise is due Professor Bell for the telephone, but for its successful introduction to the world at large we must not forget that Theo. N. Vail stepped to the front at the critical time and gave the company an impetus, through his excellent management, not exceeded by any man known in connection with a corporation of any kind in this country. To his foresight, wonderful energy, keen discernment, tact and pluck, and his trust in his lieutenants, he may be credited with forming a business scarcely excelled in this country, which produces an income that is without a parallel, when the original capital is considered. He finds time to not only invent and originate new ideas in the business of the company, of which he is the general manager, but is an inventor of no ordinary type. Some of his creations are remarkable, and are used largely in the system. He is not only the general manager of the American Bell Telephone Company, but president of the New England Telephone Company, director in twenty more subcompanies of the parent concern, but gives direction to the manufacturing company, which makes all the apparatus used by the telephone companies of the world. This company has factories in Chicago, New York and Boston, which are the largest of their kind in the world, being not confined to telephone construction, but manufacture everything in the electrical line. So the young man steps to the front as the best exemplar of the policy of the times. He awaits no better times, but makes the best of the present, and crosses the bridge only when he comes to it. To Professor Bell, as the inventor of the telephone, we give all honor for the discovery, but to Theo. N. Vail, as the general manager, we must give as much honor, for it was he who, with his able associates, devised the ways, means and methods by which it was placed in the hands of the public, who so appreciate its service to them.

In reaching a conclusion, one may say that it is probable Professor Bell could have met with success ordinarily, and the public served in a manner, but Theo. N. Vail knew the public and how to reach it, and there are those who are fully acquainted with telephone matters who do not hesitate to accord to Mr. Vail the greater honor, for it was he only who brought the telephone and its systems to the splendid commercial success it has to-day obtained. J. T. B.

The Protection of Submarine Cables in Time of War.

The London *Electrical Review* says that the question of the protection of submarine cables in war time is of especial importance to England from her geographical position, since her sole telegraphic communication with the rest of the world depends on submarine cables, and particularly as such large tracts of ocean intervene between England and her colonies.

The international law on this subject agreed to in the convention drawn up in Paris by the powers, a short time ago, practically leaves the question untouched, as each power reserves to itself complete liberty of action. Let us suppose England to be at war with a strong naval power. Undoubtedly one of the first steps taken by the enemy would be to interrupt our telegraphic communication wherever possible.

To avoid international complications, those sections of submarine cables having their extremities in English territory would certainly be first selected for interruption.

In the case of a section having one end in English territory and the other in that of a neutral state, should this state be weak the cable would assuredly be interrupted.

In the case of a section between two neutral states, the cable would probably be left intact, though its existence might afford material assistance to England.

This condition of affairs is decidedly more disadvantageous to England than to any other power, and especially with regard to her communications with the East, in which, with only the exceptions of Lisbon, Alexandria, Suez and Banjoewanzie, the extremities of the submarine cables connecting England with India and Australasia are landed on British territory, and, consequently, would be completely at the mercy of a hostile power.

For communication with China we should have to depend entirely on the overland route through Denmark, Russia and Siberia, and by way of the cables connecting Siberia with Japan and China—evidently a very undesirable route.

Our communications with the Cape are subject to the same danger, the only sections on that route which would certainly be uninterrupted are those connecting Zanzibar, Mozambique and Delagoa, all in Portuguese territory.

From the above statements, it is evident that our communications with our principal colonies, *via* the Eastern Telegraph Company's systems, are entirely at the mercy of an enemy.

We will now turn to the transatlantic cables. With the exception of those starting from France and terminating at St Pierre, Miquelon (a French possession), all the direct cables between Europe and America start from England, and are landed in the Dominion of Canada. These would certainly be interrupted by an enemy. Again, were France that enemy, we on our part would certainly cut the two remaining cables, viz., those between Brest and St. Pierre.

Fortunately for the telegraphic communication between the United States and Europe, there exists a route by way of Mexico, the west coast of Central and South America, across the Andes to Buenos Ayres, along the Brazilian coast to Pernambuco, and thence to St. Vincent, Madeira and Lisbon. This route would be of less use to England than to any other power in Europe on account of our insular position.

In the interest of England, it is, therefore, evident that the only manner of securing telegraphic communication is to have at least one extremity of each cable in neutral territory.

Sir James Anderson, in a recent interesting communication to the *Pall Mall Gazette*, naturally looked at the question in the interest of the company which he represents, and whose success is almost entirely due to his able management. He certainly touched on a point which merits great attention, and that is, that dispatch vessels belonging to the English navy should be fitted with means of lifting cables at any points arranged, and telegraphing on their own account. We would even go further than this, and suggest that every dispatch vessel should be fitted so as to be able to undertake the destruction or repair of submarine cables, and for this purpose should carry on board, besides the necessary machinery, say from forty to fifty miles of submarine cable. Enough has been said to show the weakness, as far as England is concerned, of the existing submarine telegraphic communication. It is here unnecessary to consider the fact that nearly all submarine cables are owned by British subjects.

Aerial Cables.

It may be of service to some of your readers, who, perhaps, are just beginning the use of aerial cables, to see a simple table which will enable them to figure the actual pull or strain upon a fixture or pole supporting such a cable.

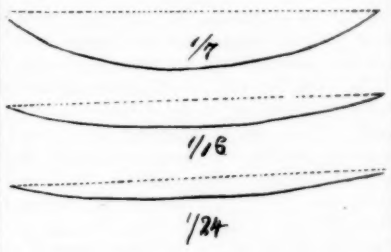
TABLE.

When deflection is $\frac{1}{4}$ of span, strain is equal to weight.
When deflection is $\frac{1}{16}$ of span, strain is equal to twice the weight.
When deflection is $\frac{1}{36}$ of span, strain is equal to three times the weight.
When deflection is $\frac{1}{64}$ of span, strain is equal to four times the weight.
When deflection is $\frac{1}{96}$ of span, strain is equal to seven and a half times the weight.

To give a little idea of the sag, I have shown in the three figures a sag of one-seventh, one-sixteenth and one-twenty-fourth the span, respectively.

As an illustration of the rule, suppose a cable weighing one and one half pounds per foot is suspended in a stretch of two hundred feet, with a sag of twelve and one-half feet (one-sixteenth the sp n), then the weight of cable suspended, allowing two feet extra length for sag, would be three hundred and three pounds, and the strain on each support would be double that amount—or six hundred and six pounds, with a like strain on every post of suspending wire or strand.

If now we should take this cable up to one-twenty-fourth of span, giving a sag of eight and one-third feet, we should shorten



the cable a trifle over one foot, and would then get a strain of slightly over nine hundred pounds at each support, and same on suspending strand.

The writer has met cable men who claimed "the torter the cable the safer," and gave as a reason "there is less dead weight" when cable is taken up tori.

The above figures, from an eminent engineer, disproves such a theory. One can easily try the experiment of stretching between two points in a room a fine wire quite tightly, and then carefully hang weights to the center until the wire is broken, then stretch another wire of the same kind between the same points, but allow it to slightly sag; this second wire will sustain the weight which broke the first one with even additional weight

The moral is then, do not suspend a cable as tort as it can be done, but allow all the sag possible, considering space, appearance, etc.

The figures in the table can be verified by comparison with any engineering work.

Signed I. H. F.

.... The annual report of Chief Walker, of the Electrical Department of Philadelphia, has been submitted. It shows the amount of work done during the past year, and says that the department is now in a better condition than it has been since it was created. The report says: "At the present time this and the other cities have one continuous network of wires, telegraph and telephone, constructed on housetops, chimneys and frail fixtures, so that the reliability of making wires overhead has become almost an impossibility owing to the interruptions caused by contact from the great number of wires over the streets and across the buildings and from the breaking and falling of wires upon those beneath them, and the constant attention of the department is required in removing wires that have fallen and crossed or become twisted with the city's wires. To obviate the trouble it is absolutely necessary to place the lines in metallic circuits. It will be necessary during the coming year to renew and form into additional metallic circuits as many of them as possible. During the year there were issued to parties who had obtained permission from Councils, 737 permits for the erection of poles and wires. There were only 190 additional new poles erected by telegraph and electric light companies, being the smallest number for many years. Belonging to the city there are 3,449 poles and 411 miles of wire, making a total of city and all other overhead wires of 5,025 miles and 8,080 poles independent of the wires belonging to the city departments. There are 12,272 attachments to city poles for the purpose of supporting 494 miles of telegraph, telephone and electric light wires belonging to corporations and individuals, for which the city received an annual rental. Eight signal boxes and two engineers' gongs were purchased and placed in position by private parties. The department had in use at the expiration of the year 292 street signal-boxes, 38 police instruments, 46 gong instruments, 3,449 telegraph poles and 411 miles of wire. 230,379 messages were sent over the wires of the department during the year, an increase of nearly 20,000 over those sent in 1883. Of this number 15,360 related to missing people, 15,930 to criminals, 10,-253 to stolen property, and 13,433 to fires. During the year 466 alarms of fires were received, 426 being one-alarm fires, 29 two-alarms, 6 three, 3 two, and 2 false alarms."

TELEGRAPHIC

.... One more factor of safety has been added to railway travel in the new invention by which trains in motion can be kept in constant communication with the stations in front and rear.

.... The receivers of the Bankers and Merchants' Telegraph Company have paid the wages of the employes; have redeemed $3,000,000 of bonds, and are arranging to redeem and cancel $2,000,000 more, which will leave the bonded debt only $5,000,000. They have also redeemed 4,700 shares of common telegram stock, worth $200,000.

.... The Bankers and Merchants' Telegraph Company have made a reduction in rates to the following points from 25c. for 10 words to 25c. for 20 words, and 1c for each additional word: Chicago, Buffalo, Springfield, Washington, Baltimore, St. Louis, Oil City, Toledo, Philadelphia, Cleveland and Pittsburg.

Kiernan's tape says: "We are advised by the officials that at a quarterly meeting of Western Union directors, to be held on March 11, the statement to be submitted will show that the earnings are in excess of those for a corresponding period of 1884, and that, after paying the usual 1½ per cent. dividend, a surplus of nearly $200,000 will be shown.

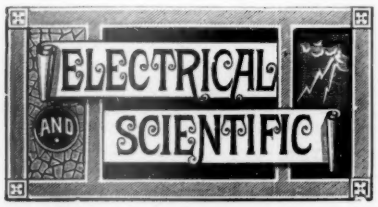
.... It appears from an official return by Cavaliere E. D'Amico, Director General of Telegraphs in Italy, that in 1883 the total length of the lines was 28,506 kilometers (17,712 miles), with 97,136 kilometers (60,-358 miles) of wire, showing an increase, as compared with 1882, of 893 kilometers (555 miles) of line and 3,417 kilometers (2 122 miles of wire. During 1883 147 new offices were opened, bringing up the number to 2,737, with 2,932 instruments. The number of telegrams, inland and foreign, was 7.176,-523, showing an increase of 124,302 over that of the preceding year. The receipts amounted to 10,971,741 lire (£438,869), and the expenses to 9,190,433 lire (£367,617), giving a net profit of 1,781,308 lire (£71,252), while the Government messages were sent free of charge.

.... The *Mexican Financier* says competition is not restricted to the transportation lines. The cable company announces another reduction in rates from the 1st of February, making the tariff per word to Europe from Vera Cruz, Mexico and Tampico as follows: Great Britain, Ireland, France, Alsace and Lorraine, 90 cents; Austria, $1.03; Belgium and Switzerland, 97 cents; Denmark and Norway, $1.02; Holland, $1; Italy and Sardinia, $1.01; Sweden, $1.07, and Spain, $1.09. The Mexican Central has reduced its rates from Mexico to all points in the United States except Louisiana and Texas to $3.34 cents for every 10 words and 29 cents for each extra word; and to points in Louisiana and Texas, $3.18 for 10 words and 27 cents for each extra word.

.... The annual report of the Mexican Telegraph Company for 1884 shows these interesting facts:

	1884.	1883.	1882.
Receipts.....	$228.804	$233,403	$152,702
Expenses....	69,896	61,582	63,391
Dividends...	114,752	95,544	91,580
Surplus.....	44,156	76,276	53.309

Since the line was opened March 3, 1881, the company has earned $700,459 30, expended $224,890.44, distributed $301,826 68, leaving a surplus of $173,742 18, of which there has been applied to construction and investment $109,078.90, leaving a net revenue Dec. 31, $64,663.28. The estimated net revenue Jan. 31, 1885, was $75,663.28; February dividend, $57,376; surplus, beyond dividend, $18,287.28. The capital stock is $1,500,000, of which 656 shares remain in the treasury. It has besides 1,362 shares of the Central and South American Telegraph Company, which cost $127,450, making the stock assets $193,050. The annual surplus is expected to prove ample for any contingent expenses.



* * It is proposed now to apply electricity to the supplying of time throughout a city, as water and gas are supplied. From a central time station small pipes will be led to all clocks in the district, by which they will be wound up and regulated.

* * Mr. William A. Harris, the well-known builder of the Harris Corliss engine, of Providence, R. I., who, it is said, with some other gentlemen, control the right for that district, for the Daft electric motor gave an exhibition recently of the motor in Providence.

* * A survey has been made for the proposed electrical railroad between Far Rockaway and Rockaway Beach, which makes the length of the road about five miles. It is intended to lay the rails on an iron superstructure, similar to that of the New York Elevated Railway, and contracts for building the line are soon to be made.

* * La Nature gives the formula of a new alloy which is especially adapted to many important uses in the arts. It melts at the low temperature of 160° Fahrenheit, or considerably below that at which the magical spoons of long ago melted in a cup of tea. Its composition is—Bismuth, forty-eight; cadmium, thirteen; lead, nineteen; tin, twenty. The alloy will withstand severe pressure.

* * The New York Press Club, under the presidency of Amos J. Cummings of the New York *Sun*, has taken a bound upward. For the first time in the history of the club, we have a representative journalist at its head, a man who is a force in himself, whose acquaintance in the upper realms of journalism enables him to bring personal influence upon his friends and acquaintances in the interest of the club. The reception on Thursday night was notable for its guests, its entertainment, its supper, its decorum and its dignity.

* * *Electrician* says that precautions should be taken with batteries in which polarization is prevented by surrounding the electrode with nitric acid, giving rise to a reduction of the acid and a disengagement of nitrous vapors. Several cases of poisoning from such vapors are on record, notably at the hospitals of Bonn and Halle. A chemist who had worked for some considerable time in the fumes of nitric acid gradually became poisoned, and his recovery was slow, while a girl actually died twelve hours after carrying a vessel of nitric acid through the streets.

* * Prof. Tyndall, in a recent lecture on electricity, produced the clothes of a man who was taking refuge under a tree when it was struck by lightning. It was a foolish thing, he observed, to go under a tree during an electric storm, unless a person stood some distance from the trunk. In this particular case, however, the man's clothes were very wet, and, though they were very much torn, they formed a sufficiently good conductor for the lightning, and he escaped with his life. Had his raiment been dry he would inevitbly been killed. Producing the man's boots, the lecturer pointed out that the uppers were torn to pieces by the electric fluid in its anxiety to reach the earth, but the sole, into the construction of which iron largely entered in the shape of hobnails, formed a good conductor and was not hurt.

* * According to recent and reliable experiments, it appears that for the transmission of power long distances, electric and wire-rope transmissions—the latter up to a length of about two-thirds of a mile—have been found the best; above that distance, electricity is to be preferred. The power of a hydraulic motor may be transmitted to distances of twelve miles without becoming more expensive than steam generated on the spot. For electrical transmission another six miles' may be added to the distance, so that in a locality where cheap water power exists machines may be actuated by electricity with advantage within a circumference of eighteen miles, beyond this distance, however, steam motors being more economical. If there is no water power, and the erection of a central steam engine becomes necessary, a wire-rope system works with greater advantage. Water and air are far exceeded by electricity for transmission of power.

* * The most remarkable electrical phenomenon recently recorded occurred at Palmer lead mines. A vivid flash of lightning, accompanied by an appalling clap of thunder, was the first intimation of any unusual condition of the elements. The bolt struck a gigantic oak tree which stood near the barn belonging to the Palmer lead furnace, some twenty feet from the ground, literally riddling and scattering its fragments in every direction to the distance of 300 yards. One piece, weighing over three hundred pounds, was hurried through the roof of the barn. The roots of the tree, even, were torn out of the ground, some of them for the distance of over twenty feet. The tree formed one of the corner-posts of a cow-shed, occupied by two horses and a cow belonging to H. C. Compton. The shed was completely demolished. The wall place was a piece of lumber 6x10 inches, and was broken in four places, while holes large enough to admit a horse were torn to the roof, and yet, strange to say, the animals were uninjured, even though a post standing between the two horses was broken in twain and the planks from the side scattered in every direction. The tree stood at one side of a lane and on the opposite side was a plank fence, which was knocked into splinters for a distance of a hundred feet along the string of plank. There was no wind at the time, and yet strange as it may seem, a part of the trunk of the tree and many of the fence planks have disappeared. Nearly every house in the village was visited by the subtle agent. Entering at the chimney of Superintendent Harrison's residence it enveloped the dress of Mrs. Harrison, who was sitting before the fire, in what had the appearance of blue flames. The alarmed lady called her husband, who had retired for the night, and he relates that for some seconds there was a rumbling sound resembling that produced by ignited paper held up the chimney.

The Hazazer Call Bell.

This bell has several advantages not possessed by other box bells. The usual base being dispensed with, the working parts are fastened to the sides of the iron box, a projection supporting the gong. The parts are protected from dust and insects by a washer, which, while moving with the rod, which carries the ball, effectually keeps the opening in which it vibrates closed. The platinum

point, which makes connection with the spring on the armature, is readily adjusted from the outside. The armature being faced with brass, and the cores thoroughly annealed, any chance of sticking is precluded. Lastly, the simplicity of its construction renders it possible for it to be sold at a low price. As an illustration of the free working of this bell, eight bells have been rung with one cell of battery.

—— The signal lights displayed at night from the flagstaff on the Post Office building by the United States Signal Office consist of a lantern of thick glass, have inside an electric light instead of the usual oil and wick.

The New England Weston.

HISTORY AND BUSINESS OF THE FIRST ELECTRIC LIGHT COMPANY IN BOSTON.

It appears that, while the Brush Electric Light Company of Boston was the first to do a public lighting in that city, the New England Weston Electric Light Company was really the pioneer in electric lighting; its earliest efforts in that direction were made in the composing rooms of the Boston *Herald*. This company was originally composed of four persons, viz.: Messrs. John Alley and R. S. Merrill of Boston, J. V. L. Rianhard of New York, and W. H. D. Chapin of Pennsylvania. The original company was the Weston Dynamo-Electric Machine Company of Newark, N. J., and had been, previous to 1877, engaged altogether in the manufacture of dynamo-electric machines to be used in electro-plating. In 1877, however, it added the industry of making and supplying dynamos and other appliances for electric lighting purposes. In January, 1880, the gentlemen named above—who at once saw that there was evidently a future for the new light—purchased the sole right to use the Weston patents of the company in the New England states, and became incorporated as an electric lighting and power company, under the laws of Connecticut, as the New England Weston Electric Light Company. The first work done by the company in New England was the placing of five arc lights in the composing room of the *Herald* in March, 1880, which were soon increased to 10 lights, and in August, 1881, the number in the composing room and offices of the *Herald* was increased to 20. It was in these early trials of the arc light in the *Herald* building that the three-wire system, which was patented by Mr. Edison within the past two years, was first used, according to Mr. Alley, who says the wires used in the three-wire circuit are still in the position in which they were originally used. In June, 1880, the second installation of the company's lights was made at Downer's Landing (Melville Gardens). This consisted of 23 arc lights of 2,000 candle power, and two lamps of 6,000 candle power each.

In September, 1880, the Downer Kerosene Company had four arc lamps put into its works at South Boston. In October and November, 1880, the Boston Rubber Shoe Company had 24 arc lamps put into its works at Malden. In December of the same year the Plymouth Cordage Company of Plymouth, Mass., had 40 lamps put in, and the Standard Sugar Refinery of Boston 10. In this latter place, the lighting company erected its first double carbon lamp at this time. In February, 1881, the Hadley Manufacturing Company of Holyoke, Mass., had five lamps put into their works (the number now used by this company being 45), and in the same month the Amoskeag Manufacturing Company of Manchester, N. H., put in 10 of the lights (and now run 210 Weston arc lights). In March following, the York Manufacturing Company of Saco, Me., had 10 lamps put into their mills; and the Springfield (Mass.) Electric Light Company was formed in the same month, starting with 22 lights—now running 50. In May, 1881, a 10 light plant was put into Oakland Garden in Boston, and in the July following the Hotel Pemberton was equipped with an installation which operated 20 lamps. In August following the Lowell Carpet Company had put into its mills at Lowell 10 arc lights. This company has since added 1,000 incandescent Weston lamps to its electric lighting equipment. In September of the same year a plant of 10 arc lights was started in Worcester.

In the meantime, the United States Electric Lighting Company of New York had acquired, by purchase nearly, if not quite, the whole of the stock of the original Weston Dynamo-Electric Machine Company, and in that way quietly absorbed it and its rights and franchises. This action made the United States Company the parent of the New England Weston Company, and called for a readjustment of the relations between the sub-company and the new one. This was effected in September, 1881, when the New England Company by an arrangement became a sub-company of the United States Company, retaining the exclusive right to use the Weston systems of arc and incandescent lighting in nearly the whole of New England. This company, after its business was established, became in turn a parent company, and, though it has an interest in the lighting plants in Boston and other places where sub-companies are operating the Weston systems, yet these companies, or the business done by them, are distinct from the New England Weston Company.

Boston has two lighting stations operating the Weston system of lights and power machines. One of these is located on Stanhope street, and has a current capacity for 400 lights, and was originally arranged for operating 1,000 arc lights. The other station is located on Eastern avenue, and has a capacity for 300 lights. The company has in Boston 141 public arc lights, and 150 lights in stores and other places, the current for which is supplied from its stations. It has, besides, 350 incandescent lamps in stores, offices, etc., including 168 in the gallery and life room of the Boston Art Club. Among the incandescent lights supplied with current by the company are the following: 125 lights in Carter, Dinsmore & Co.'s building on Columbus avenue; 25 lights to J. C. Nichols, Fiske's wharf; 20 lights to the Shipman Engine Company, Franklin street. There are also 21 mogul incandescent lamps of 125 candle power each in the mercantile establishments of Carruth, Zinn, Bigelow Bros. & Kennard, and Percival; and the company has orders for placing a considerable number of these lamps in other stores, which they are now filling. Among the isolated plants in Boston are: Hinckley Locomotive works, running 20 arc lights; the Hoosac Tunnel Dock and Elevator Company, 50 lights; the Rockwood Manufacturing Company of East Boston, 20 lights; E. Hodge & Co., East Boston, 3 lights; the Highland Skating Rink is supplied by the company with 22 arc lights, and L. Prang & Co. with 26 arc lights. In Newport, R. I., there is a sub-company now running 75 arc lights, and another in Manchester, N. H, operating the same number of lights. The Gilbert Manufacturing Company of Ware, Mass., operates 15 arc lamps in its mills; the Holyoke Warp Company of Holyoke, Mass., 11; the Renfrew Mills of Adams, Mass., 88, and the Merrimac Company of Lowell, Mass., 10. In addition to those enumerated there are, in various sections of New England, operated isolated plants, 993 Weston arc lights, put in by the New England Weston Company. The Weston incandeston system in New England outside of Boston, and in manufacturing establishments, seems to meet with a favorable reception, judging by the number of installations and lamps in use. The following is a list of the manufacturing concerns using these lights, and the number of lamps operated by each:

	Number of lamps in use
Valley Forge Company, R. I.	308
F. A. Johnston, Portland, Me.	108
Pacific Mills, Lawrence, Mass.	592
Nourse Mills, Woonsocket, R. I.	583
American Watch Co., Waltham, Mass.	195
Lowell Manufacturing Co., Lowell, Mass.	1,000
Morgan Spring Co., Worcester, Mass.	30
Boston Manufacturing Co., Waltham, Mass.	130
Merrimac Manufacturing Co., Lowell, Mass	200
C. W. Lunn, Stoughton, Mass.	152
Lymanville Co., North Providence, R.I.	177
Saxonville Mills, Saxonville, Mass.	277
Total, outside of Boston	3,752

These figures are being constantly added to, so that it will not be many years before all our manufacturing establishments in New England will be supplied with arc or incandescent electric lights, as they may think best suited to their work.

In addition to the lights furnished in Boston from the electric lighting stations of the New England Weston Company, there are four motors now running supplied with

the electric current from these stations. These deliver from one to two horse power each. One operated at 44 Boylston street runs three blacksmiths' forges and two lathes. The others are at 45 North Market steet, 25 Avon street and 52 St. James street, and are used to operate sewing machines. A six horse power and a nine horse power motor are now engaged.

The record of the Weston, as well as that of the Brush, is of great suggestiveness in regard to the future of artificial lighting. It shows that our manufacturing concerns are gradually but surely eliminating the dangerous illuminant, gas, from their mills. The next step will be to substitute it in dwelling houses for the oxygen-consuming gas light—insuring not only the better safety of these houses from fire, but the better health of their occupants; and who can say but in the not very distant future we shall also have our houses heated by the electric current.

Brush Electric Light Co.

PIONEER STREET LIGHTING COMPANY IN BOSTON—OPERATIONS IN NEW ENGLAND.

In the matter of electric illumination of streets and squares in Boston, the Brush Electric Light Company of New England may be said to be the pioneer. In May, 1881, three private l ghts were put in—two on Court street, between Sudbury and Bowdoin square, and one on Green street. Later in the summer six lights were put in on Scollay square and Court street, without expense to the city, to show the people how much better electricity would light the streets and squares of the city than gas. On Feb. 15, 1882, the city adopted five of these lights, since which time there has been a steady increase in the number of electric lights on the streets, squares, public garden, &c. This increase may be noted by the following table:

	Electric Lights.
On Jan. 1, 1883, the city used.....	114
On Jan. 1, 1884, the city used.....	381
On Jan. 1, 1885, the city used.....	401

The legitimate increase in the year 1884 should have been much greater, and would have been were it not that the Committee of the Board of Aldermen having supervision of the lamp department was opposed to electric lighting, and did all in its power to aid in replacing electric lights with large gas lanterns, much to the disgust and vexation of the public, who favored the electric lights. Of the 401 electric lights employed by the city, the Brush Company furnishes 218, or over one half; the Weston Company, 141; and the American System (Merchants' and Union Companies), 42. Including the lamps run for the city, the Brush Company has 634 lamps in operation in mercantile establishments in Boston. In addition to these, it has 76 lights on the Boston and Albany Railway stations and terminal grounds in this city; 18 lights in the Norway Iron Works, South Boston; 16 in the South Boston Iron Works; 18 in the establishment of Freeland, Loomis & Co., the first concern in Boston to use electric lights, and three lights in the Whittier Machine Company's Works at South end. In all, then, it would appear that there are 765 Brush Electric Lights used in Boston, all of which are lighted by the company, except those used by the Boston and Albany corporation, which are run from an isolated plant owned by that company. The Brush Company has two electric lighting stations in Boston—one on Lancaster street, near the Fitchburg depot, and one in Reid's block, on Harrison avenue. The company is now erecting a central lighting station on the vacant lot, corner of Columbus avenue and Ferdinand street, nearly opposite the Providence depot the huge chimney for which has already been built. The station will cover an area of twelve thousand feet of land and when completed will furnish the current for all the lights supplied by the company, a plant being contemplated which will operate 2,000 arc lights of 2,000 candle-power each. This capacity can be doubled at any time, if necessary. The building will be three stories in height; the first story, which also takes in the basement, will be 20 feet high in the clear, and the two upper stories each 15 feet high. When this station is completed, which it is expected will be some time in May, the lighting stations on Lancaster street and Harrison avenue will be discontinued, and the business of generating electricity transferred to the new station.

In addition to the lights in Boston, the Brush Company has a number of isolated plants throughout New England, in mills, factories, &c. At Springfield the Boston and Albany Railroad Company runs 19 Brush lights; the Amoskeag Manufacturing Company of Manchester, N. H., 300 lights, and the Amoskeag Locomotive Works, 12 lights; the Nashua Iron and Steel Works of Nashua, N. H., runs 5 lamps; the Renfrew Manufacturing Company of Adams, Mass., 76 lights; the Graylock Mills of North Adams, 20 lights; the Atlantic Mills of Providence, R. I., 270 lights; the Riverside Mills, same place, 300 lights (these mills being run night and day, except Sundays, with two sets of hands); the Wanskuk Manufacturing Company (also of Providence), 80 lights; the Sales Manufacturing Company of Salesville, R. I., 68 lights; the Gardiner (Me.) Coliseum Company 20 arc lights and 20 Brush-Swan incandescent lamps, the latter operated from a storage battery (the only storage plant in operation in New England): the Willimantic Thread Company of Willimantic, Ct., 76 lights; the Berkeley Manufacturing Company of Providence, R. I., 60 lights; the Whittenton Manufacturing Company of Whittenton, Mass., 135 lights: the Cohannet Mills of Taunton, Mass., 20 lights; the Burlington Woolen Mills of Burlington, 60 lights; the Bigelow Carpet Company, of Clinton, Mass., 18 lights; the Everett Mills of Lawrence, Mass., 42 lights; the Russell Paper Company of Bellows Falls, Vt., 3 lights, and the Benedict and Burnham Manufacturing Company of Waterbury, Ct., 25 lights. In all, the company has outside of Boston in New England, isolated plants which aggregate 1,603 arc lamps; or, including Boston, it operates in New England 2,368 arc lamps. In addition to this there is a Brush Electric Lighting Company in New Haven, Ct., the number of lamps operated by which, however, is not known.

In the matter of incandescent lighting, in addition to the plant of 20 Brush-Swan incandescent lamps, run by a storage battery in Gardiner, Me, there is an isolated plant at the art tile works of the Lowes in Chelsea, Mass., consisting of 75 lamps. These lamps are run by dynamo current, and give the greatest satisfaction. This branch of the company's business is, however, only in its infancy, and efforts are to be made to introduce the light in factories, large buildings, and houses in connection with the arc lighting system of the company. Another thing is now actually being done in arc lighting. The success of the effort to subdivide the arc light has enabled the company to put in 1,200 candle power lamps instead of the 2,000 candle power lamps heretofore used. This will be of great advantage in factories, where a more even distribution of the light is called for, and as two of the smaller lights will not cost much more than one of the large lights, there will be no lack of economy in the new deal, while the advantage will be altogether obvious to the factory people.

There are now in the United States 110 Brush arc light companies, all tributary to the parent Brush Company, of Cleveland, Ohio.

The Brush Company of Boston, of which his honor Mayor O'Brien has been treasurer from the start, seems to be a successful company. It shows a confidence in the future by the erection of a large and expensive lighting station. The extent of its conducting wires can be judged when it is known that it has stretched throughout the city of Boston 136 miles of No. 6 copper wire conductors. Electric lighting is yet in its infancy. What will it be ten, or even five, years hence?

The City of Topeka, Kansas, is the possessor of an electric light tower, 150 feet high, that has for nearly two years past been used as an ornament alone, on account of the condition of the city's finances. During the present biennial session of the Legislature of Kansas it was decided to have the tower lighted by private subscription, and this was done to the great satisfaction of the habitues of the State House, over which the light sheds its br'ghtest rays; and, strange to say (for such things generally go contrariwise), no member has as yet introduced a bill to put all electric wires underground or asked for other injurious legislation aimed at these companies. Perhaps, to use a sad simile, the bright electric light acted as a stumbling block.

The following instructions have been issued to linemen by President Bates of the Baltimore and Ohio Telegraph Co.:

INSTRUCTIONS REGARDING THE USE OF HARD-DRAWN COPPER WIRE.

To all Linemen:

The hard-drawn copper wire used by this company, while possessing sufficient hardness and tenacity for its legitimate use, will not stand the rough handling to which iron wire may be subjected without injury.

In order, therefore, that danger of bruising or marring it may be avoided, while in transit or being strung, the following directions must be complied with:

Every coil should be examined before the sacking is removed. In case the covering is frayed or torn, the sacking should be closely inspected to see that it has not been cut or marred from the same cause that injured the sacking. In case the wire is found to have sustained injury, the coil must not be used unless the injured portion can be easily cut out.

Coils of copper wire should never be thrown from a moving train.

While unreeling the wire great care must be taken to avoid twists and kinks. Whenever a kink is found it must be cut out, and a good splice made. This also applies to splits or indentation of any kind.

In tying the wire to the insulator, the wire should not be tied so as to touch the glass. The tie wire should first be put entirely around the glass, one twist made in it, then the line wire brought up and the two ends of the tie wire twisted around it, with at least five turns, thus leaving the line wire without bends or kinks. When done, the projecting ends must be twisted off, using the pinching portion of the Helvin Grip for this purpose.

Care should be taken that the hard drawn wire be not stretched as tightly as iron wire under like conditions, that it may not be broken by contraction in cold weather.

Hard drawn copper wire must always be joined with the Helvin splice, whether in constructing new lines, or in repairing breaks upon finished wires. No excuse will be accepted for the use of any other splice. Linemen must always carry with them a plentiful supply of the couplings.

Splices must be made in strict accordance with the following directions. Separate cards containing them may be obtained from head linemen.

DIRECTIONS FOR MAKING THE HELVIN SPLICE ON HARD-DRAWN COPPER WIRE.

Place the brass coupling in the "Grip" or clamp, and secure it by means of the catch at the ends of the handles. Run the two ends of the wires to be spliced through the holes in the coupling letting each project about five inches. Then, with the unemployed hand (pliers must not be used) wind each end closely around the wire as it enters the coupling, taking particular pains to see that the first turn is close to the coupling, that each turn fits closely to the straight wire, and that at least five turns are made. When this is done, put a little powdered rosin on the two wires where they enter the coupling at each end, still keeping the Grip upon the splice. Then solder quickly with soft wire solder. Finally, when cold, break off (do not cut) the projecting ends of the wires.

Pliers, vises, or holdfasts must never be used on hard drawn copper wire. Linemen found using them will be promptly dismissed.

Linemen in charge of sections should provide themselves with the "Helvin Grip," which will be furnished by the Supply Department upon requisition in due form.

ELECTRIC LIGHT NEWS

—— A comparative exhibition of gas and electricity is to take place in Brussels some time this year.

—— The Vienna Skating Club has lately given a grand ball on ice, illuminated by 20 electric arc lamps.

—— The gas jets in the Hippodrome, at Paris, are to be replaced by 800 incandescent electric lights of the Edison type.

—— The theater in Monaco is to be lighted exclusively by electricity. A new form of lamp is to be used with a view to increasing the scenic effect.

—— O. Hammond, Jr., Baltimore, Md., wholesale dealer in fresh meat, is putting in a 400-light Edison plant, and a Ball automatic cut-off engine to drive it.

—— At the annual meeting of the Sperry Electric Light Company of Chicago, the following officers were elected: Dr. Galusha Anderson, President; C. B. Nelson, Vice-President; E. B. Palmer, Secretary and Treasurer; Elmer A. Sperry, Electrician; C. M. Greene, General Manager. Board of Directors—Galusha Anderson, C. B. Nelson, E. B. Palmer, E. A. Sperry, W. T. Tisdale, F. H. Ludington, Jesse Vandenburgh.

—— Mr. Eric Bruce, in his lectures upon the electric light, says that, for private house lighting purposes, the storage of energy is almost indispensable. If a dynamo machine only is used, the lights could only be maintained when the machine is working; but, if the energy could be stored, the lights would be available at any time. Many persons now used the electric light in their houses, and even in bed-rooms as a night light which they could turn on and off at any time, simply because they had an accumulator. He had used an accumulator four or five weeks, during which time it was only charged twice or thrice, and there was not a single breakdown. The lecturer explained by means of experiments the construction and working of a storage battery, and illustrated the principle by burning portions of magnesium wire.

—— The danger incurred by the use of very high tension current dynamos is certainly one of the most serious obstacles to the development of electric lighting from large central stations. A French electrician, M. d'Arsonval, professor at the College de France, has recently (January 26) communicated a paper to the Academy of Sciences, in which he describes how he has been enabled to render the employment of such machines absolutely free from danger. He introduced the subject by the often-repeated remark that it is not so much the current itself which is the source of peril, as the counter current, set up at the moment of breaking or making contact. It is on this account that with equal tension, alternating currents, which are only currents of opposite values, succeeding each other suddenly, produce physiological effects vastly more energetic than continuous currents. M. d'Arsonval concludes from this that batteries and dynamos giving currents of equal tension and equal strength may be very unequally dangerous, and that even a current that may be dangerous in one circuit need not be so in another. To do away with all risk, it is sufficient to prevent the extra current to traverse the body of the experimenter, and to do this it is only necessary to place in connection with the terminals of the dynamo a series of small voltameters with lead plates and acidulated water, in sufficient number that the electromotive force of polarization may be greater than the electromotive force of the machine. This arrangement is claimed to set up an absolute barrier for the direct current, whilst the extra current passes freely. At the moment when the circuit is broken the extra current traverses the voltameters, and the safety of the experimenter is guaranteed. The efficiency of this method can be very easily tested.

ELECTRICAL PATENTS

INDEX OF INVENTIONS FOR WHICH LETTERS PATENT OF THE UNITED STATES WERE GRANTED IN THE WEEK ENDING FEBRUARY 17, 1885.

312,285 Means for Lighting Lamps; Sylvanus E. Miller, Jersey City, N. J., assignor to Wm. Bell, New York, N. Y.

312,339 Galvanic Element; Alfred Dun, Frankfort-on-the-Main, Germany.

312,340 Apparatus for Emptying and Charging galvanic elements; Alfred Dun, Frankfort-on-the-Maine, Germany.

312,365 Telephone; James Lowth, Chicago, Ill.

312,366 Telephone; James Lowth, Chicago, Ill.

312,394 Hanging balanced electric lamp; Thos. T. Smith, London, England.

312,405 Insulated Electrical Conductor; Wm. P. Thomas and Edward J. Frost, Philadelphia, Pa.

312,409 Telephone Transmitter; Henry E. Waite, New York, N. Y.

312,410 Switchboard; Henry E. Waite, New York, N. Y.

312,452 Incandescent Light; Otto B. Fahnehjelm, Stockholm, Sweden.

312,482 Apparatus for Synchronizing Clocks; John A. Lund, London, England, assignor to the Standard Time Company, New Haven, Conn.

312,487 Electro-Magnetic Comb; Wm. F. McGinnis, New York, N. Y.

312,492 Telephone; Wm. R. Miller, Baltimore, Md.

312,503 Receiving Instrument for Electrical Reporting; Wm. M. Pease, Pittsburgh, Pa., assignor of one-half to Lenox Simpson, same place.

312,504 Alarm Mechanism, and Apparatus fo Operating the Same; Wm. M. Pease, Pittsburgh, Pa., assignor of one-half to Lenox Simpson, same place.

312,506 Railway-car Telegraph; Lucius J Phelps, New York, N. Y., assignor to the Railway Telegraph Company, of New York.

312,511 Electro-Magnet; Ernest F. Recordon, Paris, France.

312,529 Cut-out for Electric Lamps; Wm. M. Thomas Grand Rapids, Mich., assignor of one-half to the Grand Rapids Electric Light and Power Company, same place.

312,533 Telephone; Thos. Wallace, New York, N. Y.

312,552 Apparatus for Treating Carbons for Incandescent Electric Lights; Edward A. Colby, Newark, N. J., assignor to the United States Electric Lighting Company, New York, N. Y.

312,557 Electric Railway; Leo Daft, Greenville, N. J.

312,579 Torpedo; Thorsten Nordenfelt, Westminster, England.

312,589 Circuit for Systems of Electric Lighting; Wm. M. Thomas, Grand Rapids, Mich, assignor of one-half to the Grand Rapids Electric Light and Power Company, same place.

312,599 Secondary Battery; Joseph W. Swan, Newcastle-upon-Tyne, County of Northumberland, assignor to the Electrical Power Storage Company, Limited, London, England.

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